TURING

The Golden Ticket: P, NP and the Search for the Impossible

寻找金钥、旅行推销员问题

地图着色问题、数独游戏、团问题

《出版人周刊》、《科学》、《纽约客》、《新科学人》热评

互联网之父Vint Cerf力荐

可能与不可能的边界

P/NP问题趣史

［美］Lance Fortnow◎著

杨帆◎译

人民邮电出版社

POSTS & TELECOM PRESS

[illegible]

[illegible]P/NP[illegible]

[illegible]Lance Fortnow

[illegible]

ISBN[illegible]978-7-115-33566-1

[illegible]

[illegible]

[illegible]

[illegible]

□□

Original edition, entitled The Golden Ticket: P, NP, and the Search for the Impossible by Lance Fortnow, ISBN: 978-0-691-15649-1 , published by Princeton University Press.

[illegible]

[illegible]Marcy[illegible]Annie [illegible]Molly[illegible]

[illegible]

——[illegible]·[illegible]

[illegible]

[illegible]

[illegible]P/NP [illegible]

P/NP[illegible]7[illegible]P/NP[illegible]

P[illegible]NP[illegible]P=NP[illegible]P=NP[illegible]

[illegible]P≠NP[illegible]P≠NP[illegible]

2008[illegible]8[illegible]ACM[illegible]·[illegible]P/NP[illegible]ACM[illegible]ACM[illegible]

[illegible]“[illegible]”[illegible]ACM[illegible]P/NP[illegible]“[illegible]”[illegible]“P/NP[illegible]”[illegible]The Status of the P versus NP Problem[illegible]2009[illegible]9[illegible]ACM[illegible]

[illegible]P/NP[illegible]

[illegible]·[illegible]
[illegible]
P/NP[illegible]P/NP[illegible]

[illegible]P/NP[illegible]P[illegible]NP[illegible]
[illegible]

[illegible]P[illegible]NP[illegible]

[illegible]·[illegible]

[illegible]

□□

□□□□Moshe Vardi□□□□□□□□□□□□□□□□□ACM□□□□□□“P/NP□□□□□”□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□Bill Gasarch□□□□□□□□□□□□□□□□□□□□□Alana Lidawer□John□Jim□□□Chris Purtilo□□□□□□□□□□□□□□□□□□□□□□KuanLing Chen□Josh Grochow□Ralph Hansen□Adam Kalinich□David Pennock□Rahul Santhanam□□□□□□□□□□□□□□□□□□□□□□□□

Manuel Blum□Steve Cook□David Johnson□Leonid Levin□Albert Meyer□□□□□□□□□□□□□□□□□P/NP□□□□□□□□Alexander Razborov□□□□□□□□□□□□□□□□□□

□□NEC□□

□□□□□□□□□□□□□□□□□□□□□□□P/NP□□□□□□□□□□□□□Juris Hartmanis□□□□□□□□□□□□□□□□□□□□□□□□□□□P□NP□□□Michael Sipser□□□

□□□6□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□Chris Bogart□HsienChih Chang□Pálvölgyi Dömötör□David Eppstein□Lukasz Grabowski□Gil Kalai□Charles Martel□□Derrick Stolee□

□□□□□□□□□□□□□Robert R. McCormick□□Marjorie Reyes□□□□□□□□□

□□□□□□□□□□□□□Vickie Kearn□□Vickie□□□Quinn Fusting□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□Marcy□□□□□□Annie□Molly□□□□□□□□□□□□□□□□

[illegible]1[illegible]　[illegible]

[illegible]

[illegible]·[illegible]·[illegible]

[illegible]

> [illegible]100[illegible]“[illegible]”[illegible]
>
> [illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]

[illegible]1000[illegible]

[illegible]1 000 000 000 000 000 000[illegible]0[illegible]1[illegible]4[illegible]Google[illegible]

[illegible]

[illegible]Mary[illegible]48[illegible]Mary[illegible]Mary[illegible]



[illegible]1-1 [illegible]

1 1[illegible]1.609[illegible]——[illegible]

[illegible]Mary[illegible]11 000[illegible]Mary[illegible]Mary[illegible]48[illegible]47[illegible]46[illegible]48×47×46×…×2×1[illegible]62[illegible]

12 413 915 592 536 072 670 862 289 047 373 375 038 521 486 354 677 760 000 000 000

[illegible]0.000 000 000 000 000 000 33[illegible]Mary[illegible]Mary[illegible]“[illegible]”[illegible]

□□□□□□□□□□□□P/NP□□□□□□□□□□□□□□□□□□□□□□□□□□□P□NP□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□□□□□□□P□□□□□□□□□
□□□□□□P=NP□□□
□□P≠NP□□□□□□□□

1.1 [illegible]

[illegible]38[illegible]

14 175, 15 055, 16 616, 17 495, 18 072, 19 390, 19 731, 22 161, 23 320, 23 717, 26 343, 28 725, 29 127, 32 257, 40 020, 41 867, 43 155, 46 298, 56 734, 57 176, 58 306, 61 848, 65 825, 66 042, 68 634, 69 189, 72 936, 74 287, 74 537, 81 942, 82 027, 82 623, 82 802, 82 988, 90 467, 97 042, 97 507, 99 564

[illegible]38[illegible]2 000 000[illegible]19[illegible]1 000 000[illegible]

[illegible]170[illegible]3800[illegible]3800[illegible]

[illegible]P/NP[illegible]

1.2 [illegible]

[illegible]

[illegible]27[illegible]5[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]——[illegible]P=NP[illegible]

P/NP[illegible]P=NP[illegible]

1.3 P/NP□□

P/NP□□
□□□□□□□□□□□□□□“□□”□□□□□□□□□□□□□□□□□

P/NP□□□□□□·□□□□1956□□□□□·□·□□□□□□□□□□□□□□□□□□□□·□□□□□
20□□□□□□□□□□□□□□□□□□□□20□□□80□□□□□P/NP□□□□□□□□□□□□
20□□70□□□□□□□□·□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□·□□
□□□□□□□□□21□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□P/NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□P/NP□□□□□□□
□□

P/NP□□□□□□□□□□□□□□□□□□□□□1994□□□□·□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□2000□□□□□□□
□□□7□□□□□□□□□□□□□□□□□□□□100□□□□□□□

1. □□□□□□□-□□□□□Birch and Swinnerton-Dyer conjecture□
2. □□□□□Hodge conjecture□
3. □□-□□□□□□□Navier-Stokes equations□
4. P/NP□□□P versus NP□
5. □□□□□□Poincaré conjecture□
6. □□□□□Riemann hypothesis□
7. □-□□□□□□Yang-Mills theory□

□□□□□□□□□□□□□□2003□□□□□□·□□□□□□□□□□□□100□□□□□□□□□□
□□□□□□□6□□□□□□□□

□□P/NP□□□□□□100□□□□□□□□□□□□□□□□

□□□□□□□□□□□P=NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□P=NP□□□□□□6□□□□□□□□□□600□□□□□□□□P=NP□P≠NP
□□□□□□□□□□□□600□□□□□□□□□□□□□□□□□□□□□

1.4 [illegible]

[illegible] GPS [illegible] “[illegible]” [illegible] 1 [illegible] 63 [illegible] 0 [illegible] GPS [illegible]

[illegible]

GPS [illegible] GPS [illegible] “[illegible]” [illegible]

[illegible] P/NP [illegible] P/NP [illegible]

1.5 [illegible]

[illegible]P[illegible]NP[illegible]P[illegible]NP[illegible]P/NP[illegible]
——“NP[illegible]”[illegible]P/NP[illegible]

[illegible]Facebook[illegible]clique[illegible]100[illegible]
1000[illegible]Facebook[illegible]

[illegible]P=NP[illegible]

[illegible]

P[illegible]NP[illegible]P/NP[illegible]

[illegible]P≠NP[illegible]·[illegible]

P≠NP[illegible]

[illegible]P/NP[illegible]P[illegible]NP[illegible]

[illegible]P/NP[illegible]

1.6 □□□□□□

□□38□□

14 175, 15 055, 16 616, 17 495, 18 072, 19 390, 19 731, 22 161, 23 320, 23 717, 26 343, 28 725, 29 127, 32 257, 40 020, 41 867, 43 155, 46 298, 56 734, 57 176, 58 306, 61 848, 65 825, 66 042, 68 634, 69 189, 72 936, 74 287, 74 537, 81 942, 82 027, 82 623, 82 802, 82 988, 90 467, 97 042, 97 507, 99 564

□□□□□□□□

15 055, 16 616, 19 390, 22 161, 26 343, 40 020, 41 867, 43 155, 46 298,57 176, 58 306, 65 825, 66 042, 69 189, 74 537, 81 942, 82 623, 82 988,90 467

□

14 175, 17 495, 18 072, 19 731, 23 320, 23 717, 28 725, 29 127, 32 257, 56 734, 61 848, 68 634, 72 936, 74 287, 82 027, 82 802, 97 042, 97 507, 99 564

□□□□□□□□□□□1 000 000□

[illegible]2[illegible] [illegible]

[illegible]20[illegible]20[illegible]20[illegible]90[illegible]

[illegible]P=NP[illegible]NP[illegible]

[illegible]NP[illegible]2026[illegible]P=NP[illegible]——[illegible]

2.1 [illegible]

2016[illegible]·[illegible]NP[illegible]P/NP[illegible]“[illegible]”[illegible]On an Open Problem of Cook[illegible]“P=NP”[illegible]

2018[illegible]100[illegible]·[illegible]

[illegible]2017[illegible]·[illegible]

[illegible]NP[illegible]-[illegible]797[illegible]

[illegible]·[illegible]NP[illegible]

“[illegible]”[illegible]

“[illegible]”[illegible]

“[illegible]”

[illegible]——[illegible]NP[illegible]NCSA[illegible]5%[illegible]

[illegible]“[illegible]”

[illegible]NP[illegible]20%[illegible]

[illegible]“[illegible]”

[illegible]“[illegible]”

[illegible]

[illegible]

“[illegible]”

“[illegible]‘[illegible]’[illegible]”

“[illegible]”

[illegible]NCSA[illegible]NP[illegible]4200[illegible]NP[illegible]“[illegible]”[illegible]

[illegible]·[illegible]

[illegible]——[illegible]·[illegible]NCSA[illegible]

[illegible]2019[illegible]10[illegible]23[illegible]

[illegible]……

2.2 [illegible]1[illegible]0

[illegible]“[illegible]”

[illegible]43[illegible]15[illegible]6[illegible]“[illegible]”

“[illegible]DNA[illegible]”

“[illegible]8[illegible]2018[illegible]”

“[illegible]DNA[illegible]DNA[illegible]”

“[illegible]”[illegible]

“[illegible]”

“[illegible]”

“[illegible]DNA[illegible]FDA[illegible]”

“[illegible]”[illegible]

“[illegible]”

[illegible]U[illegible]“[illegible]DNA[illegible]”

“[illegible]”

“[illegible]”[illegible]“[illegible]”

2.3 [illegible]

“[illegible]”[illegible]12[illegible]2026[illegible]

[illegible]2004[illegible]Major League Baseball[illegible]·[illegible]2005[illegible]Sports Scheduling Group[illegible]12[illegible]

[illegible]

[illegible]9[illegible]

[illegible]15[illegible]

[illegible]

[illegible]

[illegible]20[illegible]20[illegible]100[illegible]89[illegible]

[illegible]

[illegible]876[illegible]

[illegible]

[illegible]·[illegible]·[illegible]1927[illegible]1998[illegible]
ESPN[illegible]

[illegible]

[illegible]

[illegible]2022[illegible]“[illegible]”

[illegible]

[illegible]

2.4 [illegible]

[illegible]14[illegible]

[illegible]14[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

17[illegible]·[illegible]Cogito ergo sum[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

> [illegible]“[illegible]”[illegible]
>
> [illegible]

[illegible]·[illegible]

[illegible]·[illegible]

1. [illegible]
2. [illegible]
3. [illegible]

[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

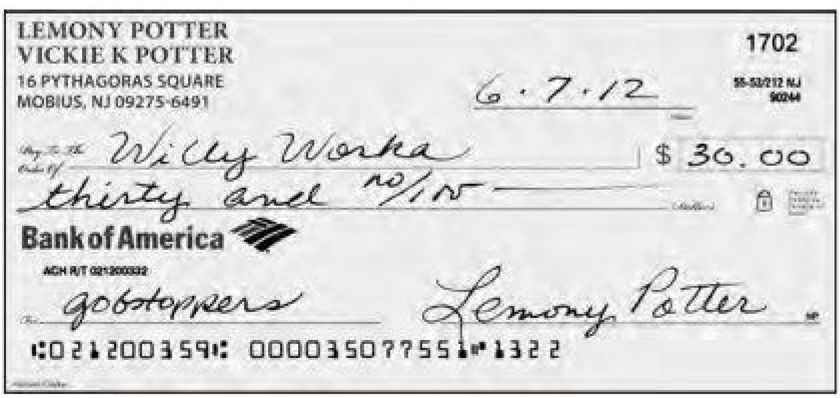
[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

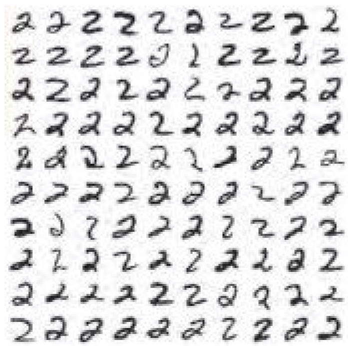
[illegible]

[illegible]“30[illegible]”[illegible]


LEMONY POTTER
VICKIE K POTTER
16 PYTHAGORAS SQUARE
MOBIUS, NJ 09275-6491
1702
6 · 7 · 12
Willy Wonka
$ 30.00
thirty and no/100
Bank of America
gobstoppers
Lemony Potter
⑆021200339⑆ 00003507755⑈ 1322

[illegible]2-1 [illegible]

[illegible]2[illegible]



□2-2　□□□□□□□2

□□□□□□□□□——□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□2□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□

□□20□□
□□□
Amazon□Netflix□Pandora□□□□□□□□□□□□□□□□□□□□□□□□□□
□□
□□□□□□□□□□□□□□□□□□□□□□□□□□2020□□□□□□□□□□□□□□□

□□
□□□□

□□
□□
□□□NP□□□

□□□□□□□□□□NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□

□□
□□□□□□□□□

2.5 [illegible]

[illegible]P=NP[illegible]“[illegible]”[illegible]

2022[illegible]·[illegible]“[illegible]”[illegible]10[illegible]32[illegible]

[illegible]2024[illegible]·[illegible]

[illegible]·[illegible]·[illegible]

[illegible]·[illegible]2026[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible]·[illegible]·[illegible]

Amazon[illegible]Amazon[illegible]NBC[illegible]“[illegible]”[illegible]Xbox[illegible]

[illegible]

2.6 [illegible]

[illegible]

[illegible]DNA[illegible]DNA[illegible]CODIS[illegible]CODIS[illegible]DNA[illegible]CODIS[illegible]DNA[illegible]DNA[illegible]

[illegible]DNA[illegible]——[illegible]·[illegible]·[illegible]DNA[illegible]DNA[illegible]DNA[illegible]·[illegible]

[illegible]DNA[illegible]·[illegible]DNA[illegible]

[illegible]38[illegible]DNA[illegible]CODIS[illegible]·[illegible]

2.7

2.8 [illegible]

[illegible]P≠NP[illegible]

[illegible]P/NP[illegible]

□3□ P□NP

3.1 [illegible]

[illegible]P[illegible]NP[illegible]——[illegible]

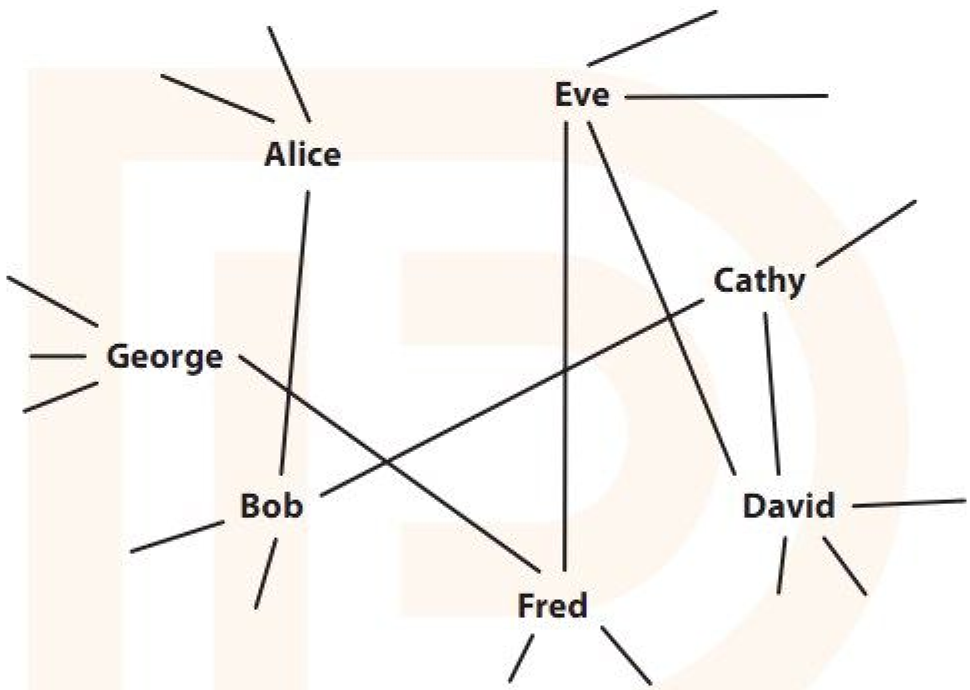
[illegible]2[illegible]

[illegible]

[illegible]Facebook[illegible]Twitter[illegible]

3.2 □□□□

□□□□□□□□□□□□□□□□□□Alice□George□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□Bob□□□



□3-1 □□□□□□□□□

□□□□□□□□Alice□George□□□□□□6□□□Alice□Bob□□□□Bob□Cathy□□□□Cathy□David□□□□David□Eve□□□□Eve□Fred□□□□Fred□George□□□“□□□”□□□“□□□□□□”

1967□□□□□□□□·□□□·□□□□□□□□□□□□□□100□□□□□□□□□□□□□□□□□□□□100□□□□□□□□□□□□□□□□□□□□□□□□□□□100□□□15□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

1. [illegible]
2. [illegible]
3. [illegible]·[illegible]
4. [illegible]·[illegible]·[illegible]

300[illegible]217[illegible]64[illegible]5.2[illegible]6[illegible]

[illegible]1994[illegible]·[illegible]*The River Wild*[illegible]“[illegible]·[illegible]”[illegible]·[illegible]·[illegible]·[illegible]·[illegible]3[illegible]1967[illegible]*A Countess from Hong Kong*[illegible]·[illegible]·[illegible]1979[illegible]*Firepower*[illegible]·[illegible]*Mystic River*[illegible]·[illegible]

[illegible]“[illegible]”[illegible]·[illegible][1]

1 [illegible]·[illegible]“[illegible]”[illegible]2[illegible]1996[illegible]“[illegible]”[illegible]

[illegible]Alice[illegible]George[illegible]6[illegible]6[illegible]Alice[illegible]George[illegible]2[illegible]6[illegible]3 198 400 279 980 000 480 000[illegible]1[illegible]100[illegible]Alice[illegible]George[illegible]

[illegible]Alice[illegible]George[illegible]

- [illegible]Alice[illegible]0[illegible]

- [illegible]Alice[illegible]1[illegible]
- [illegible]1[illegible]2[illegible]
- [illegible]2[illegible]3[illegible]
- [illegible]George[illegible]
- [illegible]George[illegible]Alice[illegible]George[illegible]

[illegible]algorithm[illegible]19[illegible]·[illegible]·[illegible]·[illegible]825[illegible]*On the Calculation with Hindu Numerals*[illegible]*Algoritmi de numero Indorum*[illegible]Al-Khwārizmī[illegible]Algoritmi[illegible]algorithm[illegible]

[illegible]50[illegible]Alice[illegible]George[illegible]Floyd-Warshall[illegible]8[illegible]1[illegible]6[illegible]

[illegible]Alice[illegible]George[illegible]Alice[illegible]George[illegible]

3.3 [illegible]

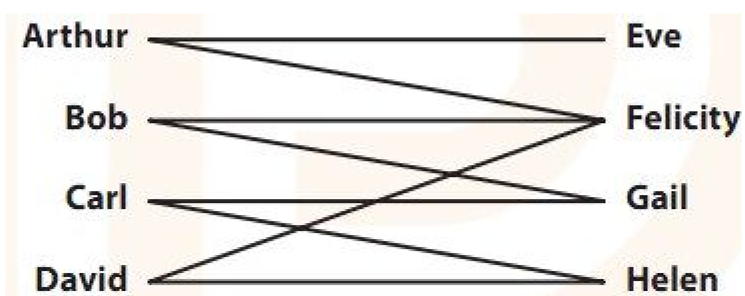
[illegible]

[illegible]
200[illegible]

[illegible]100[illegible]99[illegible]98[illegible]100[illegible]99[illegible]
98[illegible]……[illegible]2[illegible]1[illegible]“100[illegible]”[illegible]100![illegible]158[illegible]
googol[illegible]googol[illegible]·[illegible]1[illegible]
100[illegible]0[illegible]

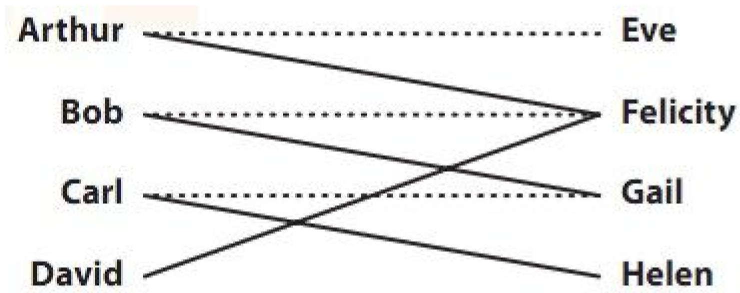
[illegible]Google[illegible]googol[illegible]googol[illegible]googol[illegible]100![illegible]

[illegible]



[illegible]3-2 [illegible]

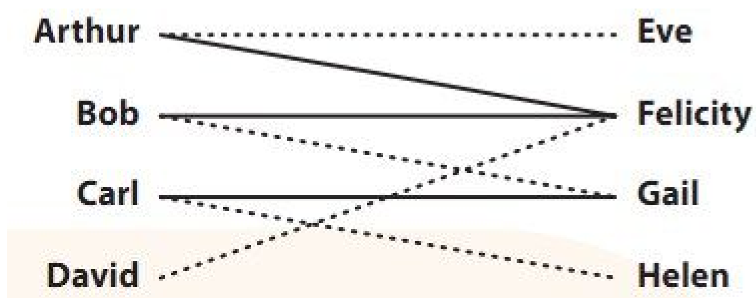
[illegible]Arthur[illegible]Eve[illegible]Bob[illegible]Felicity[illegible]Carl[illegible]Gail[illegible]



[illegible]3-3 [illegible]

[illegible]

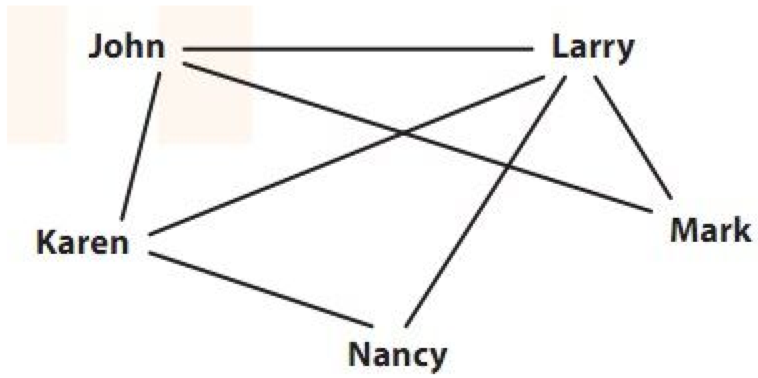
David[illegible]Felicity[illegible]Felicity[illegible]Bob[illegible]Bob[illegible]Gail[illegible]Gail[illegible]Carl[illegible]Carl[illegible]Helen[illegible]Bob[illegible]Feliciy[illegible]Carl[illegible]Gail[illegible]



[illegible]3-4 [illegible]

[illegible]augmenting path[illegible]1957[illegible]·[illegible]98%[illegible]

[illegible]



[illegible]3-5 [illegible]

[illegible]·[illegible]1965[illegible]“[illegible]”[illegible]Path, Trees and Flowers[illegible]97%[illegible]

“[illegible]”[illegible]100[illegible]100^4[illegible]100^4[illegible]1[illegible]2[illegible]78[illegible]0[illegible]“[illegible]”[illegible]“[illegible]”[illegible]100^4[illegible]100^2[illegible]100^{12}[illegible]——P[illegible]polynomial[illegible]“[illegible]”[illegible]P/NP[illegible]P[illegible]

3.4 [illegible]

[illegible]50[illegible]“[illegible]50[illegible]”[illegible]

[illegible]50[illegible]151[illegible]50[illegible]50[illegible]25[illegible]50[illegible]

[illegible]“[illegible]”[illegible]Alpha Society[illegible]50[illegible]“[illegible]”[illegible]50[illegible]1225[illegible]50[illegible]

3.5 “□□□”

□□

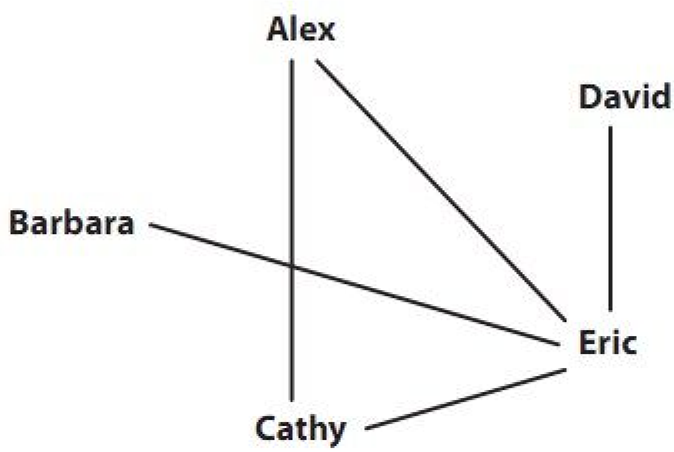
□□□□□□□□□□□□“□□□”□□□□□□□□□□□□□□□□“□”□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□

□□□□□□

1. □□□□□□□□□□□
2. □□□□□□□□□□□□□□□□□□□□□

□□5□□□□□□□□□□

□Barbara□□□□□□□□□Eric□Eric□□Alex□□□□□□□□□Cathy□Eric□□□
□□□David□□□□□□□□

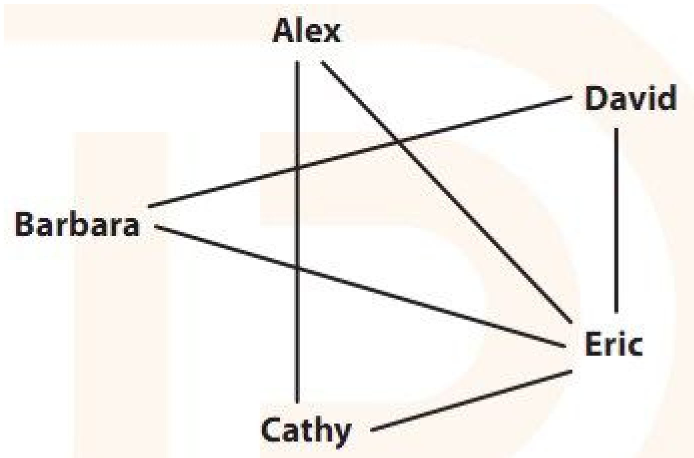


□3-6 □□□

□□□David□
Barbara□□□1□□□□□□□□□Cathy□Alex□□□2□□4□□□□□□□□□□□□□□
□□□
□□□□□□□□□□□□

□□

[illegible]Alex[illegible]Eric[illegible]David[illegible]Barbara[illegible]Eric[illegible]
Cathy[illegible]Alex[illegible]



[illegible]3-7 [illegible]

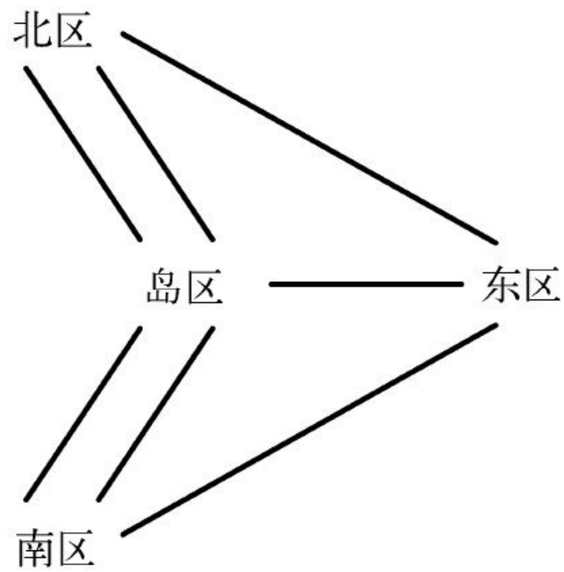
“[illegible]”[illegible]19[illegible]



[illegible]3-8 [illegible]

[illegible]1735[illegible]·[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]



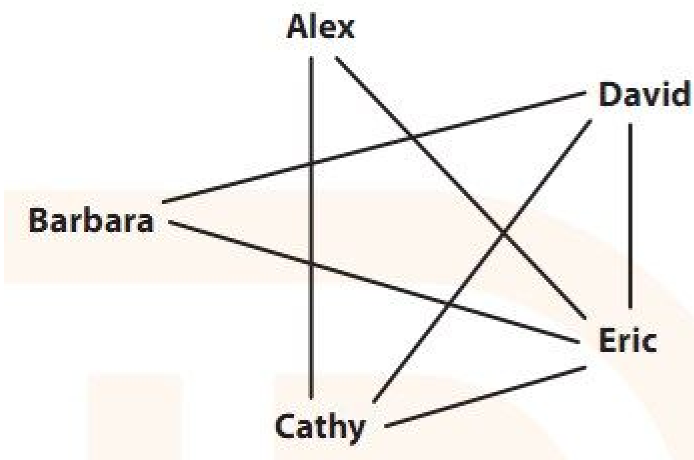
[illegible]3-9 [illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]2”[illegible]

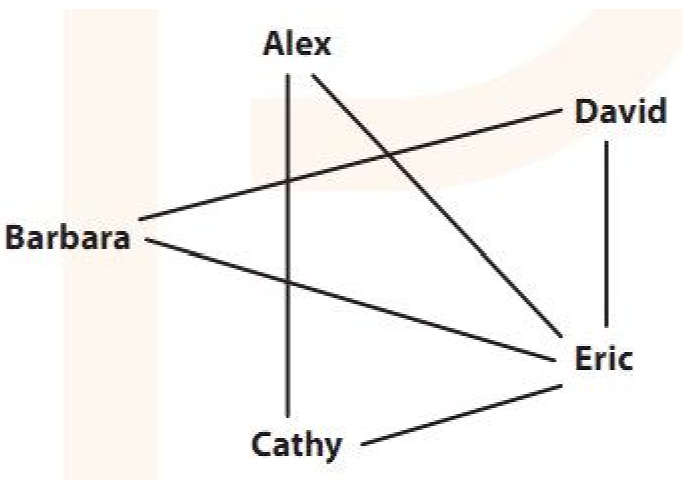
1. [illegible]
2. [illegible]

[illegible]David[illegible]Barbara[illegible]Eric[illegible]Alex[illegible]Cathy[illegible]David[illegible]



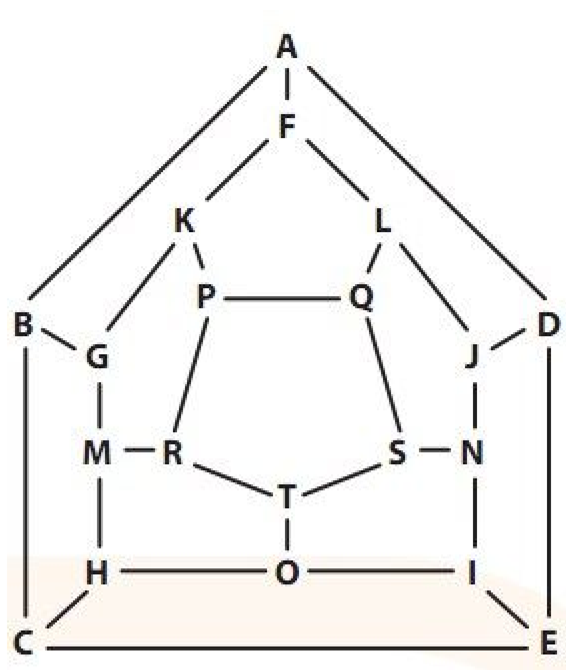
□3-10　□□□□□“□□□”

□□□□□□□□□□□□□□□□□□□□“□□□2”□



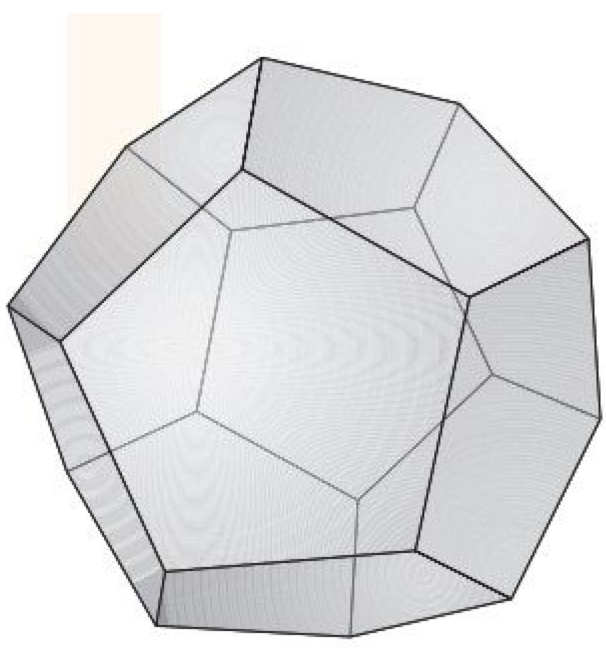
□3-11　□□□□□□“□□□”

□□□□□□□□□□□□□□“□□□2”□□□□□□□□□□□□□□□□□□“□□□2”□□□□□□□□1857□□□□□□□·□□·□□□□□□□□□Icosian□□□□□□□□□□□□“□□□2”□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□



□3-12　Icosian□□

Icosian□□□□□□□□□□□□□□□□□□□□□□



□3-13　□□□□

□□□

[illegible]Icosian[illegible]“[illegible]2”[illegible]

3.6 [illegible]

[illegible]

[illegible]

[illegible]12[illegible]13[illegible]13[illegible]

1852[illegible]·[illegible]1879[illegible]1880[illegible]“[illegible]”[illegible]·[illegible]·[illegible]11[illegible]

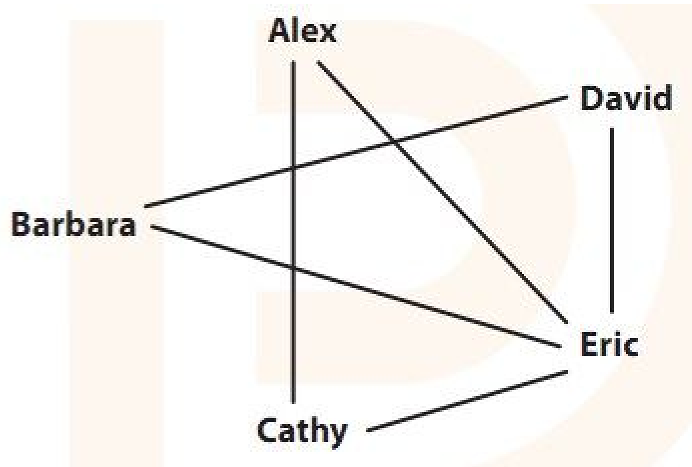
1976[illegible]·[illegible]·[illegible]-[illegible]

[illegible]


俄勒冈州
爱达荷州
内华达州
犹他州
加利福尼亚州
亚利桑那州

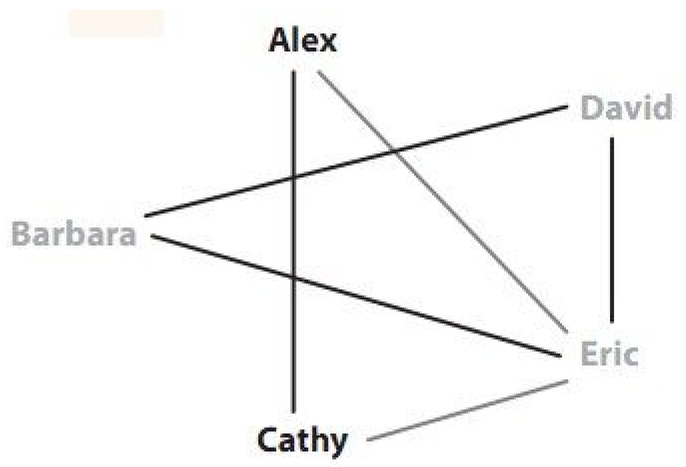
3.7 □□

□□□□□□□□□□500□□“□□□”□□□□□□□□□□□□□□□



□3-15 □□

□□□□□□□□□Alex□Cathy□□□□□Barbara□David□Eric□□□□□□□□□□□□□□□□Alex—Eric□□Cathy—Eric□□□□□□□□□□□□□□□



□3-16 □□□□□

[illegible]500[illegible]17[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]1995[illegible]·[illegible]·[illegible]1321[illegible]1505[illegible]

3.8 P□NP

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□“□□□2”□□□“□□”□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□□□□□□□□□□□□□□nondeterministic polynomial time□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□□□

□□□□□□□□P□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□“□□□1”□□□□□□□□

□□□P□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□P/NP□□□P=NP□□□□□□□□□□□□□NP□□□NP□□□□□□□□□□□□□□□□□□□□□□P□□□□□NP□

□□P□□□□NP□□□P≠NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□P/NP□□□

3.9 [illegible]

[illegible]NP[illegible]P/NP[illegible]

1. [illegible]

[illegible]23[illegible]A[illegible]adenine[illegible]C[illegible]cytosine[illegible]G[illegible]guanine[illegible]T[illegible]thymine[illegible]ACTGATTACA[illegible]4700[illegible]2[illegible]4700[illegible]DNA[illegible]20[illegible]1000[illegible]NP[illegible]DNA[illegible]NP[illegible]

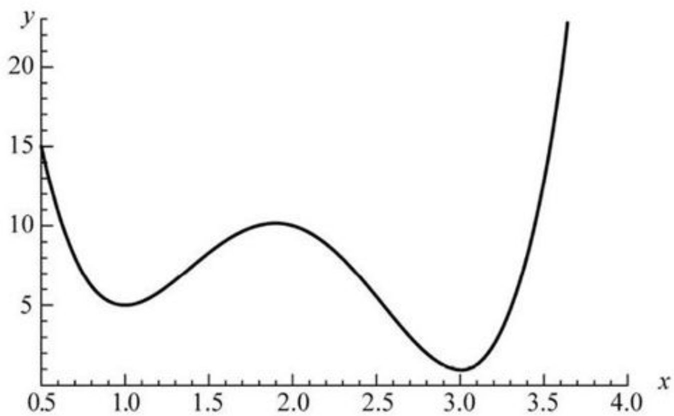
DNA[illegible]RNA[illegible]mRNA[illegible]mRNA[illegible]P/NP[illegible]

[illegible]protein threading[illegible]mRNA[illegible]NP[illegible]

2. [illegible]

[illegible]NP[illegible]

[illegible]3-17[illegible]3.0[illegible]1.0[illegible]



$y=7x^4-55x^3+148x^2-159x+64,\ 0.5\leqslant x\leqslant 4.0$

[illegible]3-17 [illegible]

[illegible]NP[illegible]9[illegible]

3. [illegible]

[illegible]NP[illegible]

[illegible]·[illegible]*A Beautiful Mind*[illegible]

4. [illegible]

1928[illegible]·[illegible]Entscheidungsproblem[illegible]1931[illegible]·[illegible]·[illegible]·[illegible]

[illegible]
NP[illegible]

[illegible]NP
[illegible]

3.10 Icosian[illegible]

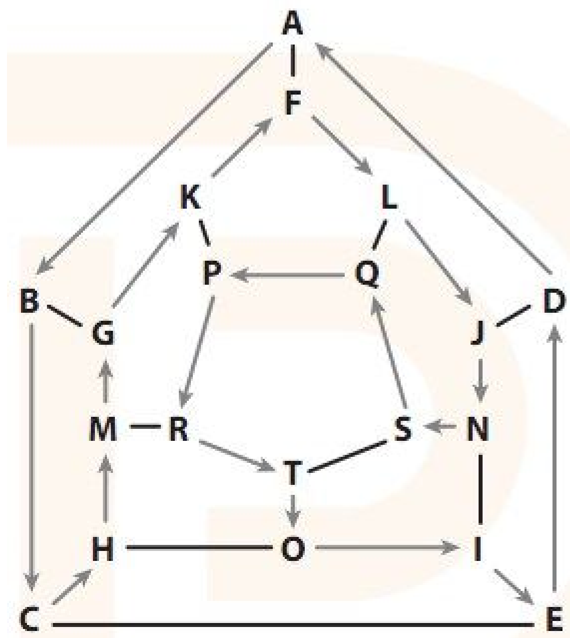


图3-18 Icosian[illegible]

[illegible]4[illegible] NP[illegible]

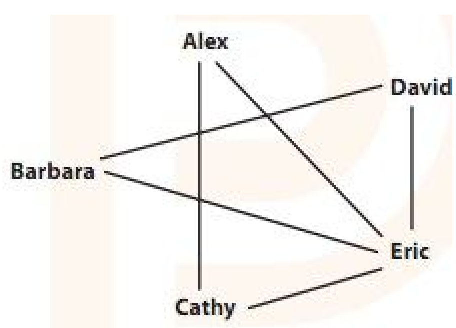
> [illegible]
>
> [illegible]
>
> [illegible]“[illegible]”[illegible]“[illegible]”
>
> ——[illegible]

4.1 [illegible]NP[illegible]

[illegible]·[illegible]1970[illegible]·[illegible]·[illegible]1970[illegible]

[illegible]ACM[illegible]（ACM Symposium on the Theory of Computing，STOC[illegible]“[illegible]”（The Complexitiy of Theorem-Proving Procedures[illegible]P/NP[illegible]

[illegible]Alex[illegible]Cathy[illegible]Eric[illegible]Alex[illegible]David[illegible]Eric[illegible]Alex[illegible]David[illegible]



[illegible]4-1 [illegible]

[illegible]Alex[illegible]David[illegible]Alex[illegible]David[illegible]Alex[illegible]David[illegible]

```
Alex not in Alpha Society OR David not in Alpha Society
```

□□□OR□□□□□□□□□□□Alex□David□□□□□□□□□□Alex□Barbara□□□□
□□□□□□□□□□□□□□□□□□□□

```
Alex not in Alpha Society OR Barbara not in Alpha Society
```

□□□□□□□□□□□□□□□□□□□□□

```
(Alex not in Alpha Society OR David not in Alpha Society) AND
(Alex not in Alpha Society OR Barbara not in Alpha Society)
```

□□Barbara□David□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□

```
(Alex not in Alpha Society OR David not in Alpha Society) AND
(Alex not in Alpha Society OR Barbara not in Alpha Society) AND
(David not in Alpha Society OR Cathy not in Alpha Society) AND
(Cathy not in Alpha Society OR Barbara not in Alpha Society)
```

□□Alex□Cathy□Eric□□□□□□□Barbara□David□□□□□□□□□□□□□OR
□□□□□□□□□□□□□□□□□□□□□□□Alex□David□Eric□□□□□□□□□□□
`(Alex not in Alpha Society OR David not in Alpha Society)`□□□□□□□□□Alex□David□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□2□□□□□□□□□□□□□□□□□□□□□Φ□Φ□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□Ψ50□□□□□□□□□□50□□□□□□□□□□□□□□□□□Ψ50□□□□□
□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□(Ψ50 AND Φ)□□□□“□□□□□□□□□□□□50□□
□”□□□□□□□□□□□□□□□□(Ψ50 AND Φ)□□□□□□□□□□□□50□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□(Ψ50 AND
Φ)□□□□□□□□“□□□(Ψ50 AND Φ)□□□□□□”□□□□□□□50□□□□□□
(Ψ50 AND Φ)□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

[illegible]

[illegible]NP[illegible]·[illegible]NP[illegible]NP[illegible]P=NP[illegible]

1971[illegible]5[illegible]4[illegible]STOC[illegible]·[illegible]

> [illegible]

P/NP[illegible]

4.2 21[illegible]

[illegible]NP[illegible]·[illegible]NP[illegible]“[illegible]”[illegible]nondeterministic polynomial time[illegible]·[illegible]

[illegible]NP[illegible]NP[illegible]NP[illegible]P=NP[illegible]

[illegible]P=NP[illegible]

[illegible]NP[illegible]19[illegible]P=NP[illegible]P≠NP[illegible]21[illegible]

[illegible]21[illegible]

[illegible]3000[illegible]21[illegible]NP[illegible]

[illegible]NP[illegible]

[illegible]

> [illegible]21[illegible]51 090 942 171 709 440 000[illegible]5100[illegible]6[illegible]FASTPASS[illegible]

[illegible] [illegible] [illegible]“[illegible]”[illegible]

[illegible]

[illegible]P≠NP[illegible]

[illegible]P/NP[illegible]

[illegible]ACM[illegible]·[illegible]20[illegible]30[illegible]ACM[illegible]1982[illegible]·[illegible]P/NP[illegible]·[illegible]1985[illegible]21[illegible]NP[illegible]

4.3 [illegible]

[illegible]P[illegible]NP[illegible]NP[illegible]
[illegible]deg({DNF [illegible]})[illegible]

[illegible][1][illegible]1974[illegible]P/NP[illegible]4[illegible]NP[illegible]1973[illegible]1973[illegible]

1 [illegible]1 [illegible]2[illegible]3[illegible]4A[illegible]www.ituring.com.cn[illegible]——[illegible]

[illegible]——herculean[illegible]formidable[illegible]arduous[illegible]intractable[illegible]obstinate[illegible]hard-boiled[illegible][2][illegible]hard-ass[illegible]

2 [illegible]Cook[illegible]“[illegible]”[illegible]——[illegible]

[illegible]“NP-complete”[illegible]NP[illegible]“complete”[illegible]“NP[illegible]”[illegible]NP[illegible]NP[illegible]

[illegible]“[illegible]”[illegible]1974[illegible]“‘NP[illegible]’[illegible]”

“NP[illegible]”[illegible]40[illegible]4[illegible]

[illegible]“NP[illegible]”[illegible]“P”[illegible]“NP”[illegible]P/NP[illegible]

□□□□□□□□□□□□□□P=NP□□□□□NP□□□□□□□□P□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□“□□□□□□□□□□□□□□□□□□□□——□□□□
□□□□□P=NP□□□□□□□□□□□□□”□□□□□□P=NP□□□□□□100□□□□□□□□
□□□

4.4 □□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□NP□□□□□1979□□□□[1]□□□□□□□□□□NP□□□□NP□□□Google□□□□NP-Complete□□□□□138 000□□□□□□□□□□1972□□2011□□□□2011□□□□1□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

1 *Computers and Intractability: A Guide to the Theory of NP-Completeness*, □□ Michael Garey□David Johnson□New York: W. H. Freeman, 1979□□

1. □□□□Dominating Set□

□□□□□□□□□50□□□□□□□□50□□□□□□1□□□□NP□□□□□

2. □□□□□□ □Partition into Triangles□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□

3. □□□□□□□

□□□Sudoku□□□□□□□□□□□□□□□□□□9×9□□□□□□□□□

5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

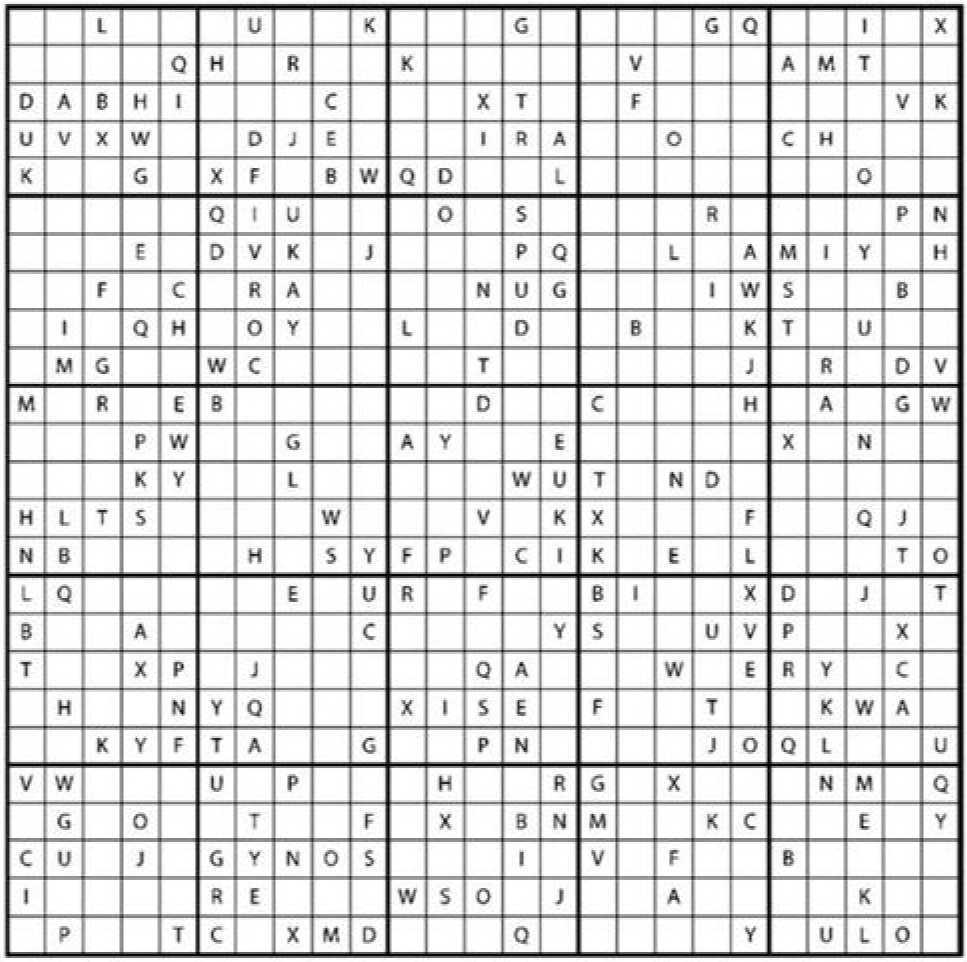
□4-2 □□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□3×3□□□□□□□□□□1□9□□□□□□□□

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

[illegible]4-3 [illegible]

[illegible]NP[illegible]



[illegible]4-4 [illegible]

[illegible]25×25[illegible]A[illegible]Y[illegible]

[illegible]100×100[illegible]

[illegible]NP[illegible]NP[illegible]

[illegible]NP[illegible]Windows[illegible]

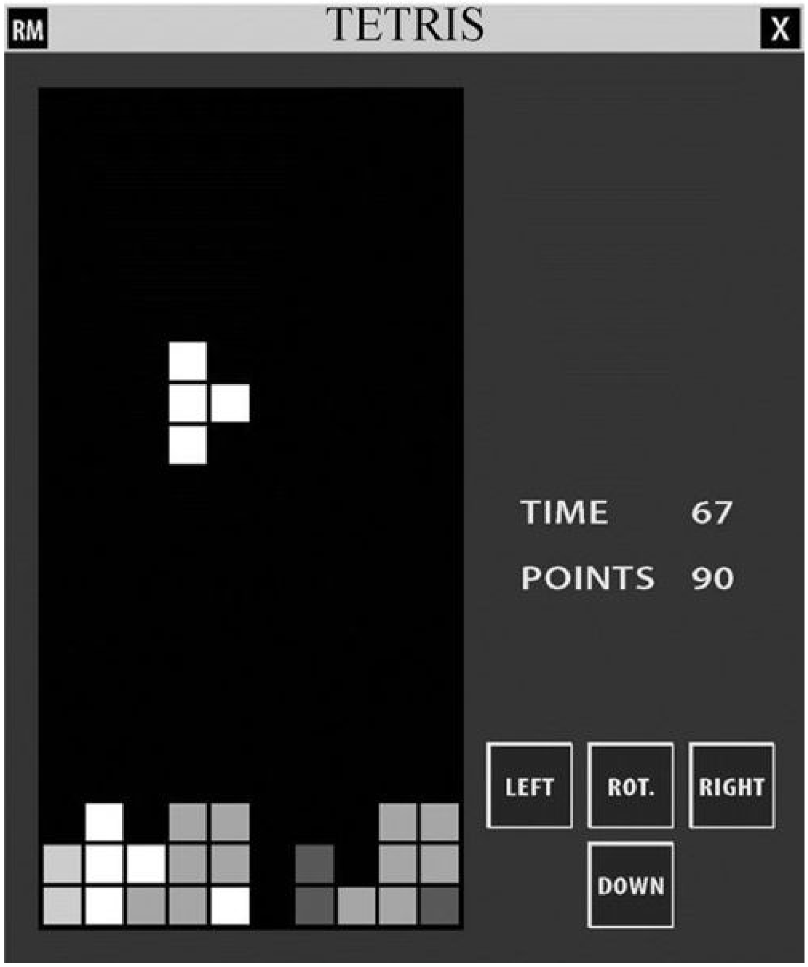

MineSweeper - Google Chro...
www.chezpoor.com/minesweeper/minecore.htm
Game Options Help

[illegible]4-5 [illegible]

[illegible]NP[illegible]


MineSweeper - Google Chro...
www.chezpoor.com/minesweeper/minecore.htm
Game
Options
Help

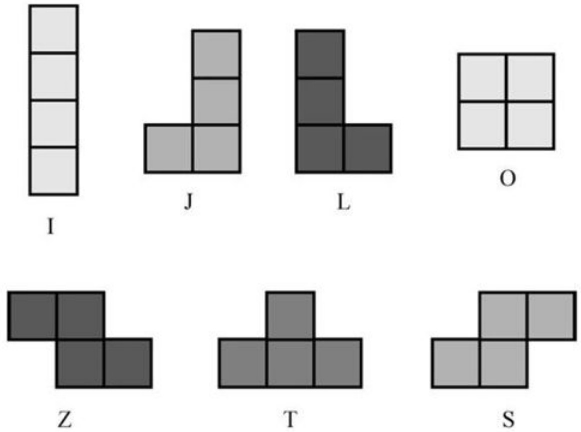
□4-6 □□□□



[illegible]4-7 [illegible]

[illegible]

[illegible]



[illegible]4-8 [illegible]

[illegible]NP[illegible]

[illegible]P=NP[illegible]



[illegible]4-9 [illegible]Tom van der Zanden

[illegible]3×3×3[illegible]

[illegible]

[illegible]

[illegible]NP[illegible]NP[illegible]NP[illegible]

4. [illegible]

[illegible]

[illegible]

[illegible]Alice[illegible]Bob[illegible]Bob[illegible]Alice[illegible]Bob[illegible]Alice[illegible]

[illegible]Bob[illegible]

[illegible]Charlie[illegible]David[illegible]David[illegible]Charlie[illegible]David[illegible]Alice[illegible]Bob[illegible]Charlie[illegible]

[illegible]-[illegible]-[illegible]

[illegible]2011[illegible]60[illegible]30[illegible]

[illegible]-[illegible]NP[illegible]P=NP[illegible]

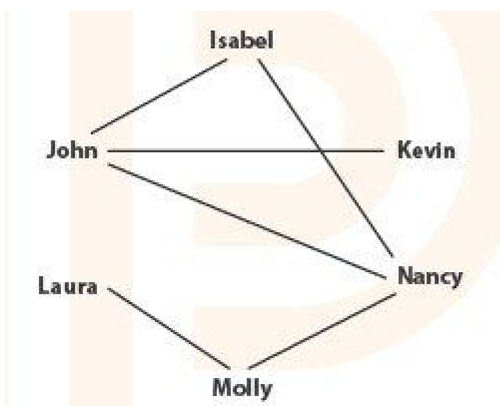
4.5 □□□□

□□□20□□70□□□□□□□□□NP□□□□□□□□□□□NP□□□□□□□□□□□□□□□□□
□P□□□□□□□NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□

1. □□□□□□

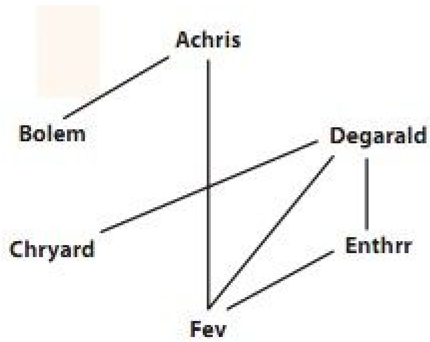
□□□□□□□□□□“□□□□”□Blade Quest□□MMORPG□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□avatar□□□□□□□□□□□□□□□□□
□□□
□□□□□□□□□□□□□□□□□□□□

Isabel□John□Kevin□Laura□Molly□Nancy□□□□□□□□□□□□□□□□□



□4-10 □□□□□□□□

□6□□□□□□□□□□□□□□□Achris□Bolem□Chyrard□Degarald□Enthrr
□Fev□□



[illegible]4-11 [illegible]

Laura[illegible]“[illegible]”[illegible]

[illegible]Isabelle[illegible]Enthrr[illegible]John[illegible]Degarald[illegible]Kevin[illegible]Chryard[illegible]Laura[illegible]Bolem[illegible]Molly[illegible]Achris[illegible]Nancy[illegible]Fev[illegible]Molly[illegible]Laura[illegible]Nancy[illegible]Achris[illegible]Bolem[illegible]Fev[illegible]

[illegible]NP[illegible]

[illegible]P[illegible]NP[illegible]NP[illegible]P[illegible]NP[illegible]

2. [illegible]

[illegible]15[illegible]15×1[illegible]5×3[illegible]24[illegible]24×1[illegible] 12×2 [illegible]8×3[illegible]6×4[illegible]17[illegible]17×1[illegible]17[illegible]1[illegible]2[illegible]3[illegible]5[illegible]7[illegible]11[illegible]13[illegible]17[illegible]19[illegible]12 978 189[illegible]316 470 269 330 255 923 143 453 723…

[illegible]1 123 467 619[illegible]1 123 467 619[illegible]33 518[illegible]1 123 467

619[illegible]

8 273 820 869 309 776 799 973 961 823 304 474 636 656
020 157 784 206 028 082 108 433 763 964 611 304 313
040 029 095 633 352 319 623

[illegible]20[illegible]70[illegible]2002[illegible]·[illegible]·[illegible]· [illegible]P[illegible]

[illegible]

8 273 820 869 309 776 799 973 961 823 304 474 636 656
020 157 784 206 028 082 108 433 763 964 611 304 313
040 029 095 633 352 319 623

[illegible]

[illegible]

[illegible]NP[illegible]
84 578 657 802 148 566 360 817 045 728 307 604 764 590
139 606 051
[illegible]
97 823 979 291 139 750 018 446 800 724 120 182 692 777
022 032 973
[illegible]
8 273 820 869 309 776 799 973 961 823 304 474 636 656
020 157 784 206 028 082 108 433 763 964 611 304 313
040 029 095 633 352 319 623

[illegible]P[illegible]NP[illegible]

[illegible]8[illegible]

3. [illegible]

[illegible]Frenemy Fancy Franks[illegible]Frenemy Fancy Franks[illegible]

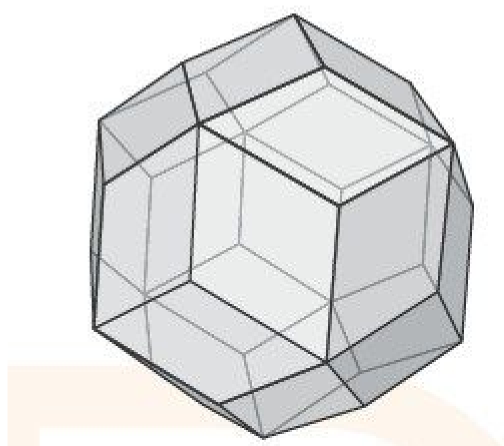
[illegible]1[illegible]2[illegible]3[illegible]4[illegible]1[illegible]1[illegible]2[illegible]3[illegible]4[illegible]1[illegible]

[illegible]

[illegible]1947[illegible]·[illegible]simplex method[illegible]

[illegible]20[illegible]70[illegible]

1979[illegible]·[illegible]ellipsoid algorithm[illegible]P[illegible]



[illegible]4-12 [illegible]

[illegible]——[illegible]

1984[illegible]·[illegible]interior point algorithm[illegible]
[illegible]
[illegible]P[illegible]

[illegible]
[illegible]20[illegible]70[illegible]
[illegible]

[illegible]5[illegible] P[illegible]NP[illegible]

> [illegible][1]

1 Georgy M. Adelson-Velsky Vladimir Arlazarov and Mikhail Donskoy *Algorithms for Games (Programirovanie Igr)* (New York: Springer-Verlag 1988).

[illegible]NP[illegible]perebor[illegible]Перебор[illegible]“[illegible]”[illegible]P/NP[illegible]

[illegible]1945[illegible]20[illegible]50[illegible]“[illegible]”[illegible]20[illegible]70[illegible]1991[illegible]

[illegible]P/NP[illegible]·[illegible]·[illegible]P=NP[illegible]P/NP[illegible]

5.1 [illegible]

[illegible]3000[illegible]20[illegible]30[illegible]

1.[illegible]·[illegible]

[illegible]DNA[illegible]

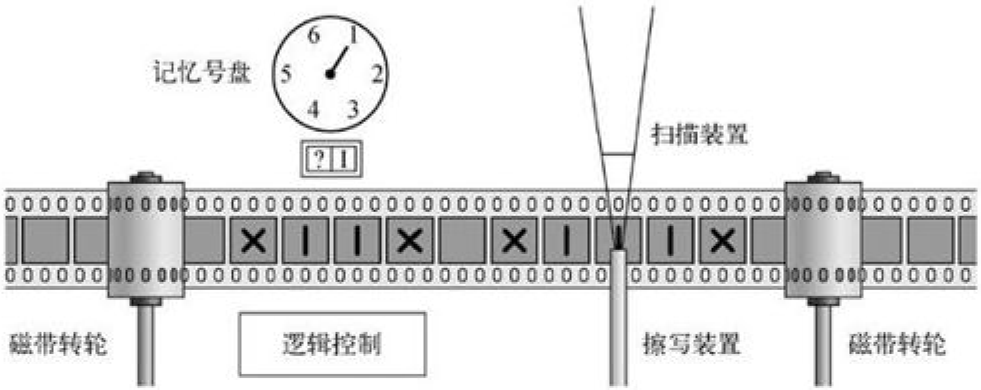
computer[illegible]17[illegible]computer[illegible]

[illegible]computer[illegible]1897[illegible]20[illegible]40[illegible]computer[illegible]

[illegible]DNA[illegible]

[illegible]1936[illegible]·[illegible]

[illegible]·[illegible]1912[illegible]20[illegible]30[illegible]



[illegible]5-1 [illegible]

[illegible]·[illegible]Lambda Calculus[illegible]λ[illegible]–[illegible]

[illegible]

[illegible]1936[illegible]

[illegible]“[illegible]”[illegible]

[illegible]1952[illegible]1954[illegible]2009[illegible]·[illegible]

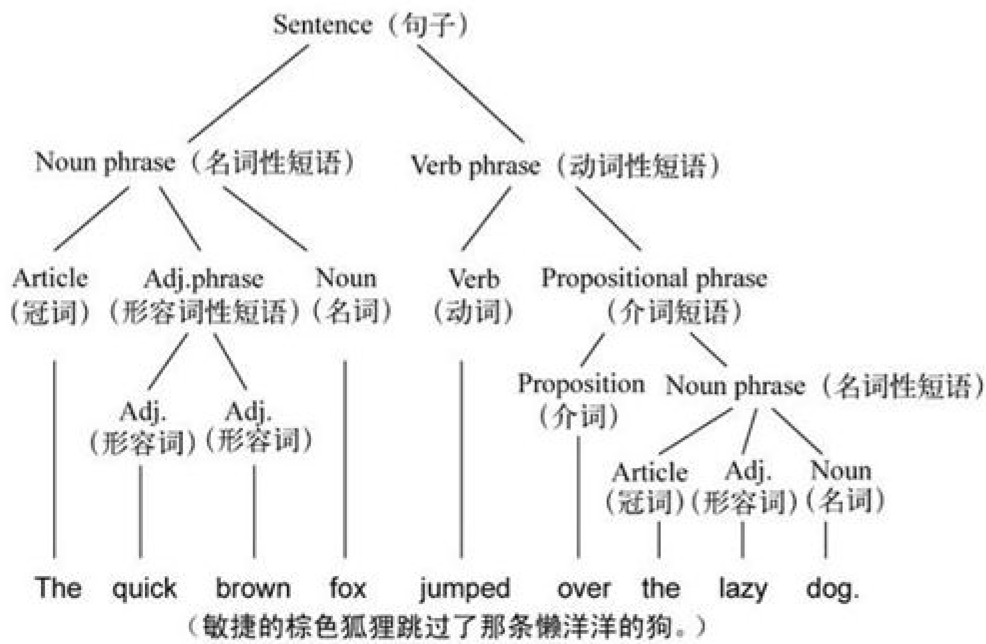
[illegible]

2.[illegible]

[illegible]20[illegible]50[illegible]

1943[illegible]·[illegible]·[illegible]neural net[illegible]20[illegible]50[illegible]·[illegible]finite automaton[illegible]

20[illegible]50[illegible]·[illegible]“[illegible]”[illegible]context-free grammar[illegible]



[illegible]5-2 [illegible]

[illegible]——[illegible]

[illegible]XML[illegible]

[illegible]1962[illegible]·[illegible]·[illegible]

□□1965□□□□□□□□□□□□□□□□On the Computational Complexity of Algorithms□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□1993□□□□□

20□□60□□□·□□

3.P□NP

□□□□□□□□□□□□20□□60□□□□□□□□□□□□□·□□□□□"□□□□□□□□"□Paths, Trees and Flowers□□□□·□□□□"□□□□□□□□□□"□The Intrinsic Computational Difficulty of Functions□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□3□□□□□□□□□□□□"□□□"□□□

> □□□□□□□□□□□"□□□□□"□□□……□□……□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□……□□……□□□

□□□□□"□□□□"□□P□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□"□□P=NP"□□

□□□□□□□□□□□P□□□□□□□□□□□□□□□□□

□□□□□□□□P□□P□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□P□□□□□□□□□□□□□□□□□

[illegible]

> [illegible]“[illegible]”[illegible]

[illegible]P[illegible]

[illegible]1971[illegible]·[illegible]NP[illegible]P/NP[illegible]NP[illegible]·[illegible]NP[illegible]

1972[illegible]IBM[illegible]T. J. [illegible]“[illegible]”[illegible]P[illegible]NP[illegible]NP[illegible]

[illegible]

> “[illegible]”[illegible]“[illegible]”[illegible][1][illegible]“[illegible]”[illegible]

1 concrete[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]

[illegible]P/NP[illegible]·[illegible]20[illegible]60[illegible]70[illegible]80[illegible]1995[illegible]20[illegible]70[illegible]“[illegible]”

5.2 □□

□□□□□“□□□□□”□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□

1. □□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
   □□□□□□□□□□□□□□□□
2. □□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
3. □□□□□□□□□□□·□□□□□□□□□P/NP□□□NP□□□□□□□□□□
   □□□□□□□□□□□□□□

1.□□□·□□□□□

□□□□□□□□□□□□□□□□□□□□20□□50□□□□□□□□□□□□□□□□□□
□□□□□□□·□□□□□□·□□□□□□1924□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□1953□□□□□□□□□□□□□□□□□□□□□·□□□□□□□□
□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□

□4□□□□□□□□□□□□□□□□□□□□AND□OR□NOT□□□□□□□□□□□□
□□□□AND□OR□NOT□□□□□□□□□□□□□□□□□□□□□□“□□”□□□□□
□□□□□□□□□□□□□□·□□□□□20□□50□□□□□□□□□□□□□□□□□□
□□

□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□P≠NP□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□

□□□
□□□□□□□□□□□□□

□□□
□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□1959□□□□□□□□□□

“”On the Impossibility of Eliminating Perebor in Solving Some Problems of Circuit Theory

“”“”1960“”On the Impossibility of Constructing Minimal Disjunctive Normal Forms for Boolean Functions by Algorithms of a Certain Class P/NP

2060

2. ·

·19031920“”20



□5-3　DILBERT © 2001 Scott Adams□□□□□□□□□□ UNIVERSALUCLICK□□□□□□□□□□□□□

□□□

- 999 999 999 999 999 999 999 999 999 999 999 999 999 999 999 999 999
- 70710678118654752440084436210484903928483593 7688474
- 982 922 216 207 267 591 232 795 977 564 268 549 473 337 889 037 097

□□“□□”□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□“9”□□□□□□□□□□□□□□□□□□□□□□0.5□□□□□□□□□□□□50□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□“□□□□□□□□□□□□”□□□□□□□□□□□□“50□9”□□□□□□□“1/√2”□□□□□□□□□□□□□□□□□982 922 216 207 267 591 232 795 977 564 268 549 473 337 889 037 097□“□□”□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□“□□□□□□□□□”□

□□□□□□□□□□□□□□□□□□□□

982 922 216 207 267 591 232 795 977 564 268 549 473 337 889 037 097

□□

982 922 216 207 267 591 232 795 977 564 268 549 473 337 889 037 097

[illegible]

[illegible]P/NP[illegible]·[illegible]P/NP[illegible]

3. [illegible]·[illegible]

1961[illegible]2800[illegible]

[illegible]·[illegible]40[illegible]1962[illegible]Y. M. [illegible]20[illegible]60[illegible]

[illegible]1984[illegible]

> [illegible]“[illegible]”[illegible]……[illegible][1]

1 * B. A. Trakhtenbort, “A Survey of Russian Approaches to Perebor Algorithms,” *Annals of the History of Computing 6*, no. 4 (October 1984).

[illegible]1963[illegible]

[illegible]·[illegible]15[illegible]

[illegible]Alice[illegible]Bob[illegible]Bob[illegible]Bob[illegible]Alice[illegible]

Alice[illegible]
[illegible]

[illegible]“[illegible]”[illegible]
[illegible]NP[illegible]6[illegible]P/NP
[illegible]

[illegible]

[illegible]

[illegible]1978[illegible]·[illegible]
[illegible]

[illegible]20[illegible]70[illegible]P/NP[illegible]
1982[illegible]20[illegible]80[illegible]NP[illegible]–[illegible]

20[illegible]80[illegible]·[illegible]
[illegible]P≠NP[illegible]7[illegible]

[illegible]

5.3 [illegible]

1956[illegible]·[illegible]·[illegible]·[illegible]P/NP[illegible]P=NP[illegible]“[illegible]‘[illegible]’[illegible]……[illegible]”[illegible]15[illegible]

[illegible]·[illegible]·[illegible]1957[illegible]20[illegible]80[illegible]1978[illegible]

[illegible]P/NP[illegible]P=NP[illegible]“[illegible]”[illegible]·[illegible]P/NP[illegible]

[illegible]1993[illegible]

5.4 [illegible]

[illegible]

[illegible]Exigius[1][illegible]–[illegible]Exigius[illegible]

1 Exigius[illegible]*My Favorite Martian*[illegible]——[illegible]

[illegible]P/NP[illegible]P/NP[illegible]NP[illegible]15[illegible]·[illegible]

[illegible]P/NP[illegible]

[illegible]6[illegible] [illegible]

[illegible]2[illegible]P=NP[illegible]

[illegible]P≠NP[illegible]“[illegible]”[illegible]P=NP[illegible]NP[illegible]P≠NP[illegible]

[illegible]Acme[illegible]Acme[illegible]A-Phone[illegible]“[illegible]NP[illegible]”[illegible]

[illegible]A-Phone[illegible]?[illegible]

NP[illegible]P≠NP[illegible]

[illegible]

[illegible]NP[illegible]

6.1 □□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□“□□”□□□□
□□□□□□□□□□□□□

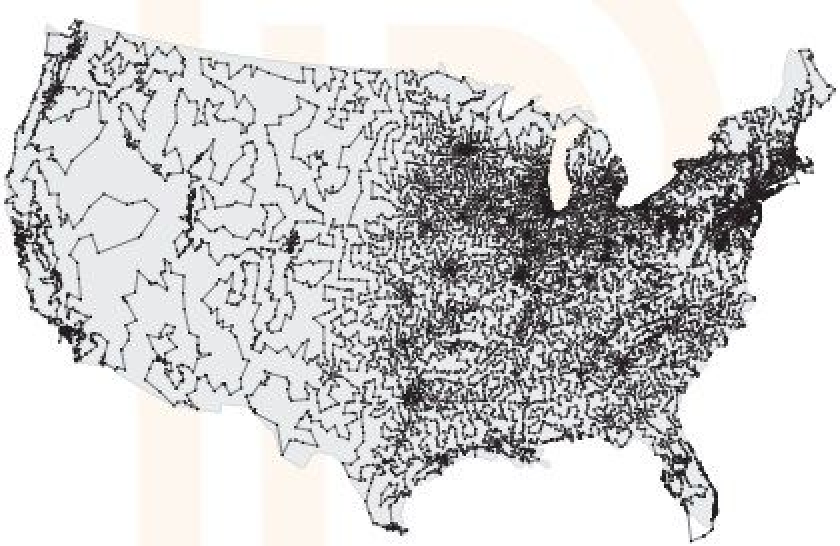
□□□□□□□□□·□□P/NP□□□□□□1971□□□□□□□□□□□□□
□□□——Intel 4004□Intel 4004□□□□□□CPU□□□□□□□□□□□
□□Intel 4004□□□□□□□□92 000□□□

□□□□□□□□□□□20□□□□□□□□□□□□□□□□□□□□□□
TRUE□FALSE□□□□□□□□□100□□□□□□19□□□□□□□□□
□□□□□□□□□□□□20□□□□□□□□

□□□25□□□□□□10□□□□30□□□□□□13□□□40□□□□□□
□□1971□□□□□□□2009□□

□□□□□□□□□□□□□□□□□□□□2009□□□□□Intel i7-870□□
□□□□□□29.3□□□□Intel 4004□3□□□□□□□□□40□□□□□□
□□10□□□□□□□□□1971□□□□40□□□□□□□□□38□□□□
□□□□2009□□□□□□□□□□1971□□□□□□□□□□□□

□□□□□NP□□□□□□□□□NP□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□1□□□□□□□□□□□□□□□500□□□
□□13 509□□6-1□□□□□□□□□

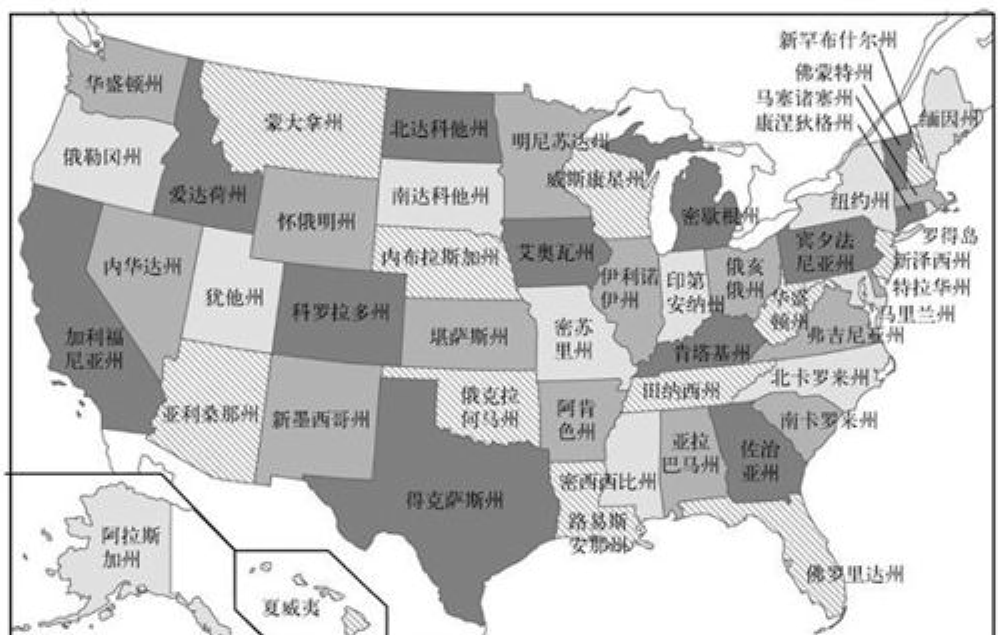


[illegible]6-1 500[illegible]

[illegible]NP[illegible]

[illegible]NP[illegible]150[illegible]2[illegible]

6.2


新罕布什尔州
佛蒙特州
马塞诸塞州
康涅狄格州
缅因州
华盛顿州
蒙大拿州
北达科他州
明尼苏达州
俄勒冈州
爱达荷州
南达科他州
威斯康星州
怀俄明州
纽约州
密歇根州
罗得岛
内华达州
内布拉斯加州
艾奥瓦州
宾夕法尼亚州
新泽西州
犹他州
科罗拉多州
伊利诺伊州
印第安纳州
俄亥俄州
特拉华州
华盛顿州
马里兰州
加利福尼亚州
堪萨斯州
密苏里州
弗吉尼亚州
肯塔基州
北卡罗来州
亚利桑那州
新墨西哥州
俄克拉何马州
阿肯色州
田纳西州
南卡罗来州
亚拉巴马州
佐治亚州
得克萨斯州
密西西比州
路易斯安那州
阿拉斯加州
夏威夷
佛罗里达州

□6-2 □□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□4□□□

□□□□□□□□□□□□



□6-3 □□□□

□□□□□□□□□□□□□□□□□□□□□□□Kotayk'□□6□□□□□□□□
□Yerevan□□4□□□□□□□□□□□□□□□□□□□□□□□□□□□□3□□□
□□□□□□□□□□□□


阿塞拜疆飞地
洛里州
塔武什州
希拉克州
阿拉加措特恩州
科泰克州
格加尔库尼克州
阿尔马维尔州
埃里温
阿拉拉特州
瓦约茨·佐尔州
阿塞拜疆飞地
休尼克州

[illegible]6-4 [illegible]

[illegible]5[illegible]5[illegible]3[illegible]


沙夫豪森
德国
Rhine
博登湖
巴塞尔
温特图尔
圣加伦
苏黎世
苏黎世湖
法国
比尔
列支敦士登
卢塞恩
奥地利
纳沙泰尔
侏罗山
伯尔尼
卢塞恩湖
弗里堡
莱茵河
库尔
纳沙泰尔湖
洛桑
日内瓦湖
阿尔卑斯山
日内瓦
马焦雷湖
杜富尔峰
意大利
卢加诺

□6-5 □□


沙夫豪森
德国
巴塞尔
莱茵河
博登湖
温特图尔
圣加伦
苏黎世
法国
比尔
苏黎世湖
列支敦士登
卢塞恩
奥地利
纳沙泰尔
侏罗山
伯尔尼
卢塞恩湖
弗里堡
莱茵河
库尔
纳沙泰尔湖
洛桑
日内瓦湖
阿尔卑斯山
马焦雷湖
日内瓦
杜富尔峰
卢加诺
意大利

□6-6 □□□□□□□□

□□6□□□□□6□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP□□□□□□□□□□□□□□□□□□□□
□□□□□□□□NP□□□□□□□□□P=NP□□□□□□□□□□□□□□□□□□□□□□□□□

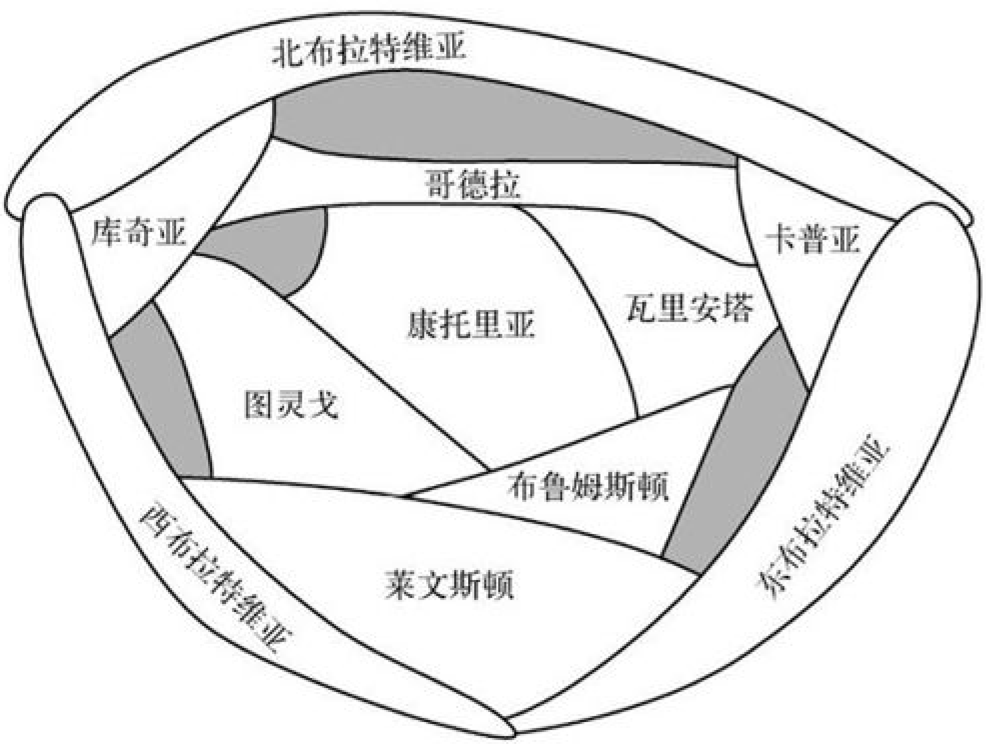
□□□□□□□□□□□□□□□□□

1. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

2. □□□□4□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□4□□□□□□□□□□□□□□□□
□□□□□□

□□□
□□□□□□□□□□□3□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□



□**6-7**　□□□□□

□□□□□4□□□
3□□□□□□11□□
□□□□□□□□□□□□□□□□□□

[illegible]The International Conference on Theory and Applications of Satisfiability Testing[illegible]SAT[1][illegible]

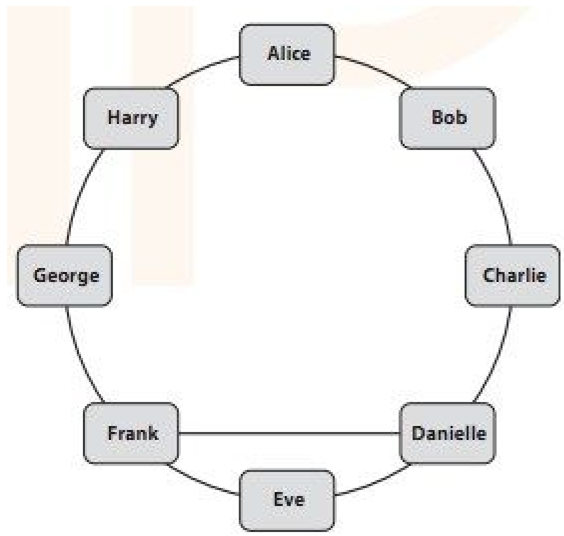
1 SAT[illegible]satisfiability[illegible] ——[illegible]

[illegible]SAT[illegible]

6.3 [illegible]

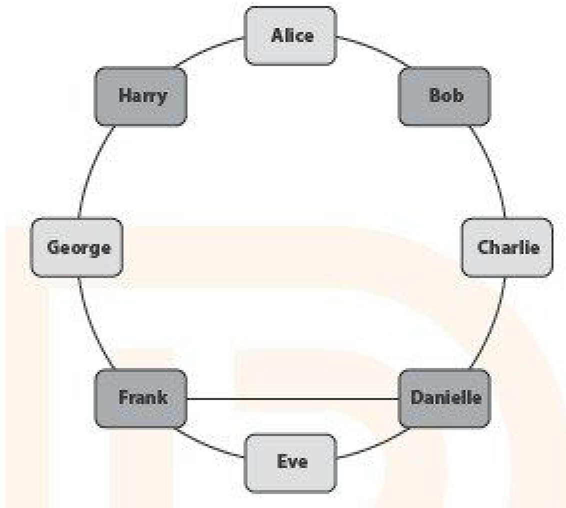
[illegible]2[illegible]3[illegible]1[illegible]4[illegible]6000[illegible]5[illegible]26[illegible]6[illegible]880[illegible]88[illegible]21[illegible]0[illegible]

[illegible]NP[illegible]very cozy group[illegible]



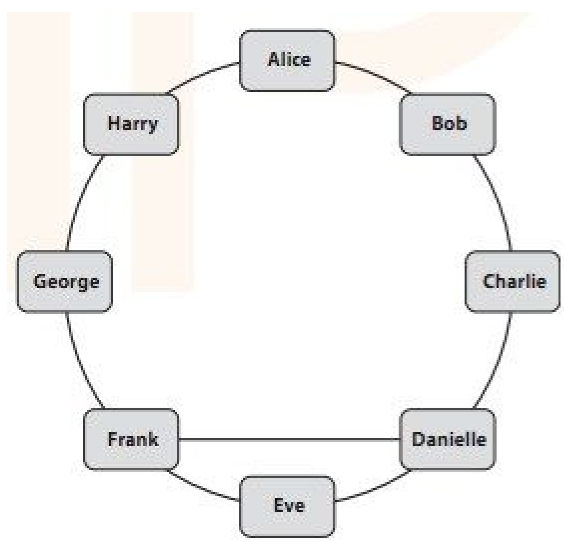
[illegible]6-8 [illegible]

[illegible]Bob[illegible]Danielle[illegible]Frank[illegible]Harry[illegible]Bob[illegible]Danielle[illegible]Frank[illegible]Harry[illegible]



□6-9　□□4□□□□□□

□□□□□□□□□□□□□3□□□□□□□□□□□□□□□Alice□Charlie□Frank□3□□□
□□□□□□□□□□□Eve□Danielle□□□George□Harry□□□□□□



□6-10　□□3□□□□□□

□□□□□□□□□□□□“□□□□□□”□□□□□□□□□NP□□□□□□□

□□□□□□□Frank□□□Frank□□□□□□□□□George□Danielle□Eve□□□□
□□□□□□□□□□Frank□□□□□□□□Frank□100□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□5□□□□□□□□□□□□□100 000□□□□□10□□□□□□□□200 000□□□□30□□□□□□601 000□——□□□□□□□□□□□□□□□□□□□□□□□□□□□□113□□□□□□□□□1□□□□□□□□□□□□□□□□□3□□□□□□□□

□□□□□□□□□□□□□□□□□□□□NP□□□113□□□

□□□□□□□150□□□□□1500□□□□□□□□□□200□□□□10□□□□□10^{21}□□□500□□□□□□38□□□51□0□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□100□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

6.4 [illegible]

[illegible]

[illegible]NP[illegible]

[illegible]50[illegible]180[illegible]181[illegible]1[illegible]

[illegible]1[illegible]1[illegible]180.5[illegible]180[illegible]181[illegible]5000[illegible]5000[illegible]180.3[illegible]

[illegible]NP[illegible]·[illegible]·[illegible]

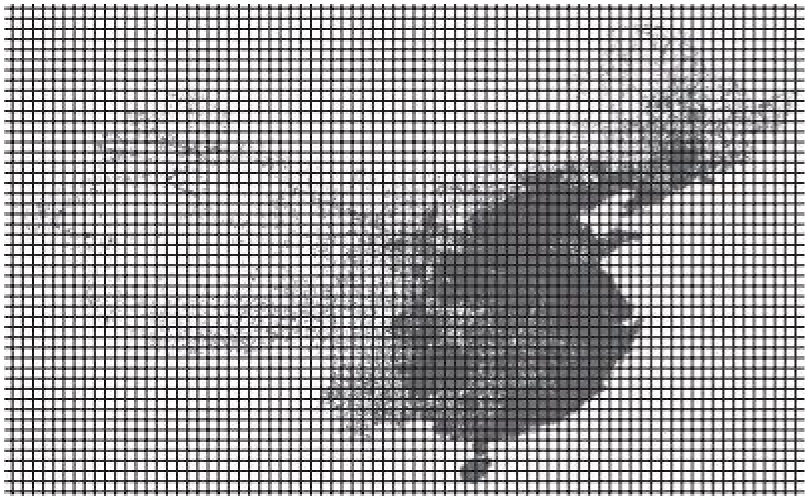
[illegible]71 009[illegible]



[illegible]6-11 [illegible]

[illegible]

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□



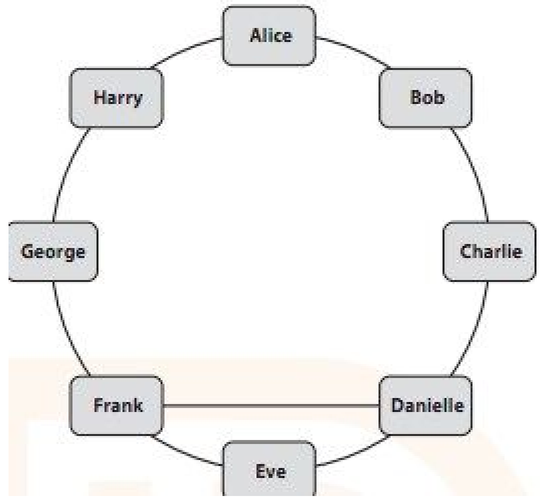
□6-12 □□□□□□□

□□□□NP□□□□□□□□□□□□□□□□□P/NP□□□2000□□□□□□□□□□□□□□□□15□□□□□□□□

□□P=NP□□0.1%□□P=NP□□□□□□□□□□□□□

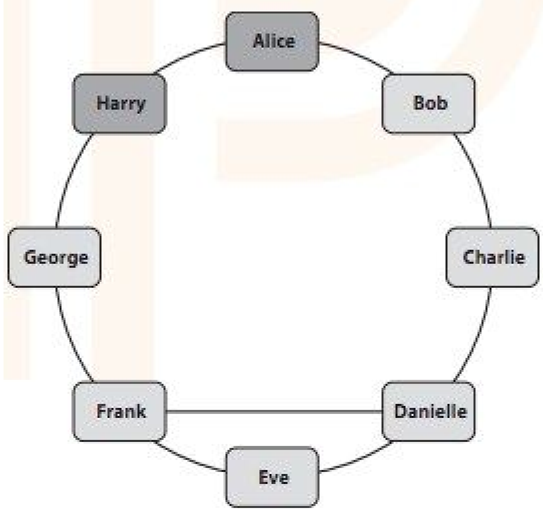
□□NP□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□4□□□□□Frank□Danielle□Harry□Bob□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□



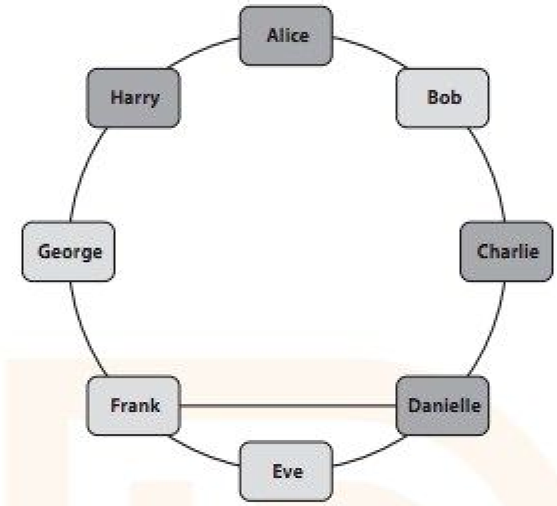
□6-13　□□□II

□□□□□□□□□□□Alice□Harry□□□□□□□



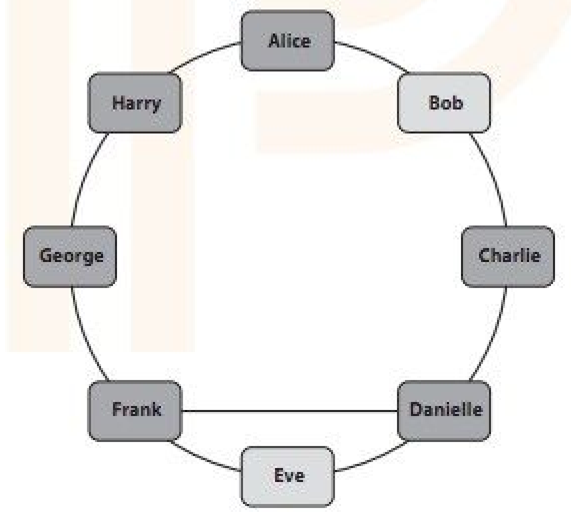
□6-14　□□□II□2□□□□

□□□□□□□□□□□□□□□□□□□□□



□6-15 □□□II□4□□□□

□□□□□□□□□□□□□□□□□□□



□6-16 □□□II□6□□□□

□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□6□□□□□□□□□□□□□□□□□□3□□□□□□□□□□□□□□□□
□□□□□3□□□□□□□□□□□□□□□□3□6□□□

[illegible]100[illegible]50[illegible]
[illegible]50[illegible]100[illegible]

[illegible]2[illegible]

[illegible]P=NP[illegible]P≠NP[illegible]
36%[illegible]36%[illegible]NP[illegible]
[illegible]1990[illegible]2005[illegible]

[illegible]100%[illegible]
[illegible]P≠NP[illegible]36%[illegible]
[illegible]50%[illegible]

[illegible]·[illegible]unique
games[illegible]
[illegible]NP[illegible][1][illegible]

1 [illegible]
http://en.wikipedia.org/wiki/Unique_games_conjecture[illegible]——[illegible]

[illegible]
[illegible]2[illegible]

6.5 [illegible]

[illegible]NP[illegible]

[illegible]Chez Turing[illegible]——[illegible]5[illegible]5[illegible]11[illegible]

[illegible]Amazon[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]

[illegible]

[illegible]

[illegible]P=NP[illegible]/[illegible]P≠NP[illegible]

[illegible]

[illegible]“[illegible]”[illegible]/[illegible]

[illegible]/[illegible]

[illegible]/[illegible]

[illegible]

[illegible]NP[illegible]

6.6 [illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]20[illegible]14[illegible]
Targets[illegible]

[illegible]NP[illegible]

6.7 [illegible]

[illegible]NP[illegible]NP[illegible]

[illegible]$P=NP$[illegible]$P \neq NP$[illegible]

□7□ □□P≠NP

□□□·□□□□□□□□□□□□□□□□□□□□□□“□□□□P□NP□□□□□□□□□□□□
□□□□”

□□□□□□□□□□□□□P/NP□□□□□□□□□□□□□□□P=NP□□□□□□□□□
□□□□P≠NP□□□□□□□

P/NP□□
□□□□□□□□□□□□□□□□□□□□□□P=NP□P≠NP□□□□□□□□□□□□□
20□□70□□□□□□□□□□“P/NP□□□□□□□□□□□□□□□□□□□”□



□7-1 DILBERT © 1997 Scott Adams□□□□□ UNIVERSALUCLICK□□□□□□□□□□□

□□□
——□□□□□1637□□□□□□□□□□□□□□□□□·□·□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□

> □□
> □□□
> □□

□□□□□□□□□0□□□□□a□b□c□□□□□2□□□n□□□$a^n+b^n=c^n$□□□□□
□□□
□□□
□□□□1994□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

[illegible]P/NP[illegible]
P/NP[illegible]P≠NP[illegible]
[illegible]NP[illegible]
[illegible]

7.1 [illegible]

[illegible]

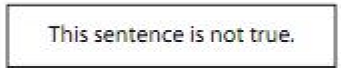


图7-2 [illegible]

[illegible]

[illegible]“[illegible]”[illegible]

20[illegible]30[illegible]·[illegible]

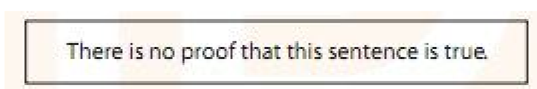


图7-3 [illegible]

[illegible]

[illegible][1]

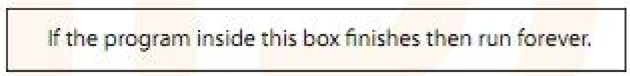
1 [illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]1936[illegible]·[illegible]

[illegible]



[illegible]**7-4** [illegible]

[illegible]PC[illegible]Mac[illegible]100[illegible]

[illegible]P[illegible]

[illegible]Q[illegible]R[illegible]

- [illegible]R[illegible]R[illegible]“Yes”[illegible]Q[illegible]“No”[illegible]
- [illegible]Q[illegible]“Yes”[illegible]

[illegible]S[illegible]Q(S)[illegible]S(S)[illegible]“No”[illegible]“Yes”[illegible]Q[illegible]

Q[illegible]Q[illegible]

[illegible]Q[illegible]NP[illegible]Q[illegible]NP[illegible]P[illegible]P≠NP[illegible]

[illegible]Q[illegible]NP[illegible]P/NP[illegible]P≠NP[illegible]

7.2 [illegible]

[illegible]

[illegible]（gate）[illegible]

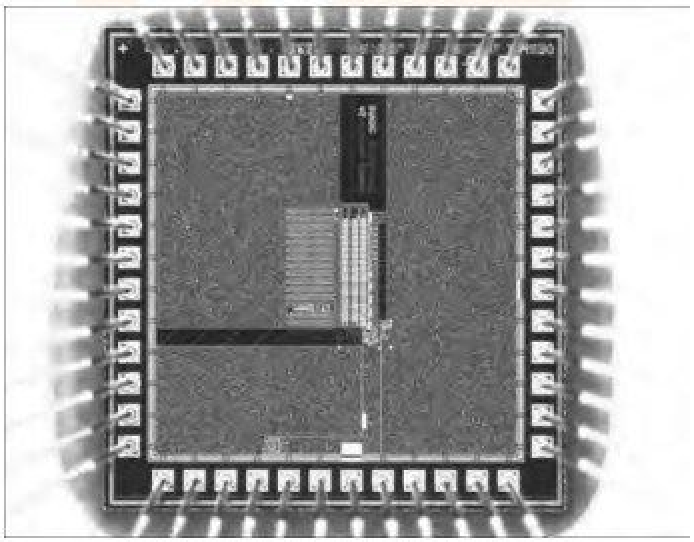


图7-5 [illegible]

[illegible]1[illegible]0[illegible]bit[illegible]“[illegible]”（binary digit）[illegible]

[illegible]（NOT gate）[illegible]

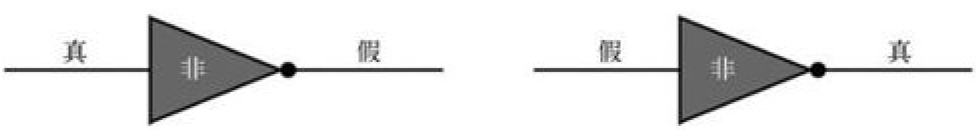
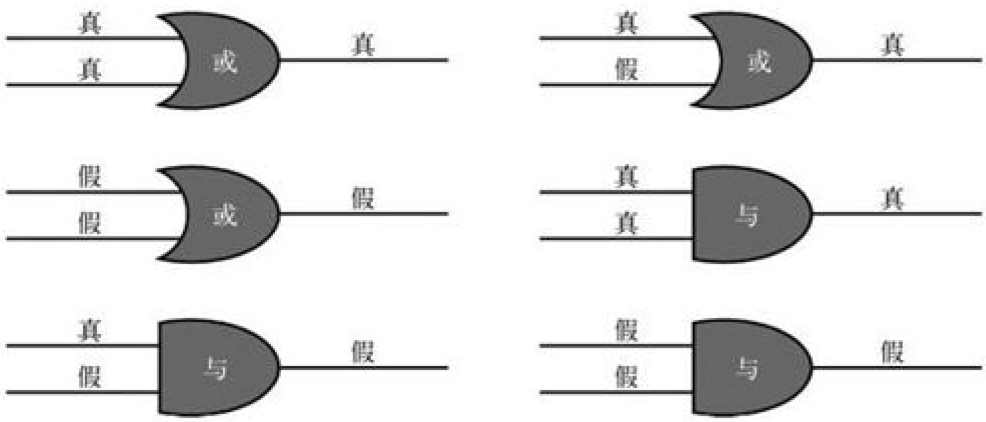


图7-6 [illegible]

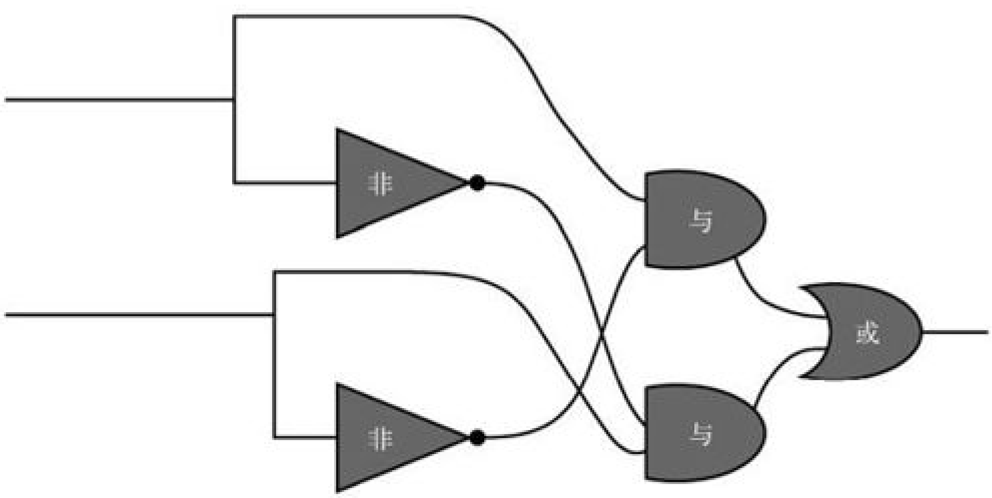
[illegible]

[illegible]AND gate[illegible]2[illegible]OR gate[illegible]2[illegible]



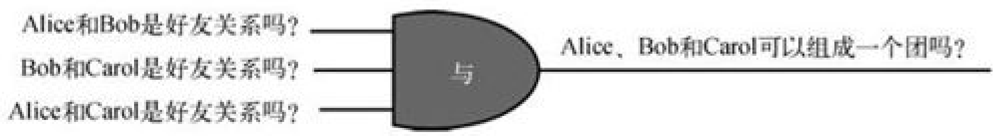
[illegible]7-7 [illegible]

[illegible]Exclusive-OR[illegible]



[illegible]7-8 [illegible]

[illegible]Alice[illegible]Bob[illegible]Carol[illegible]



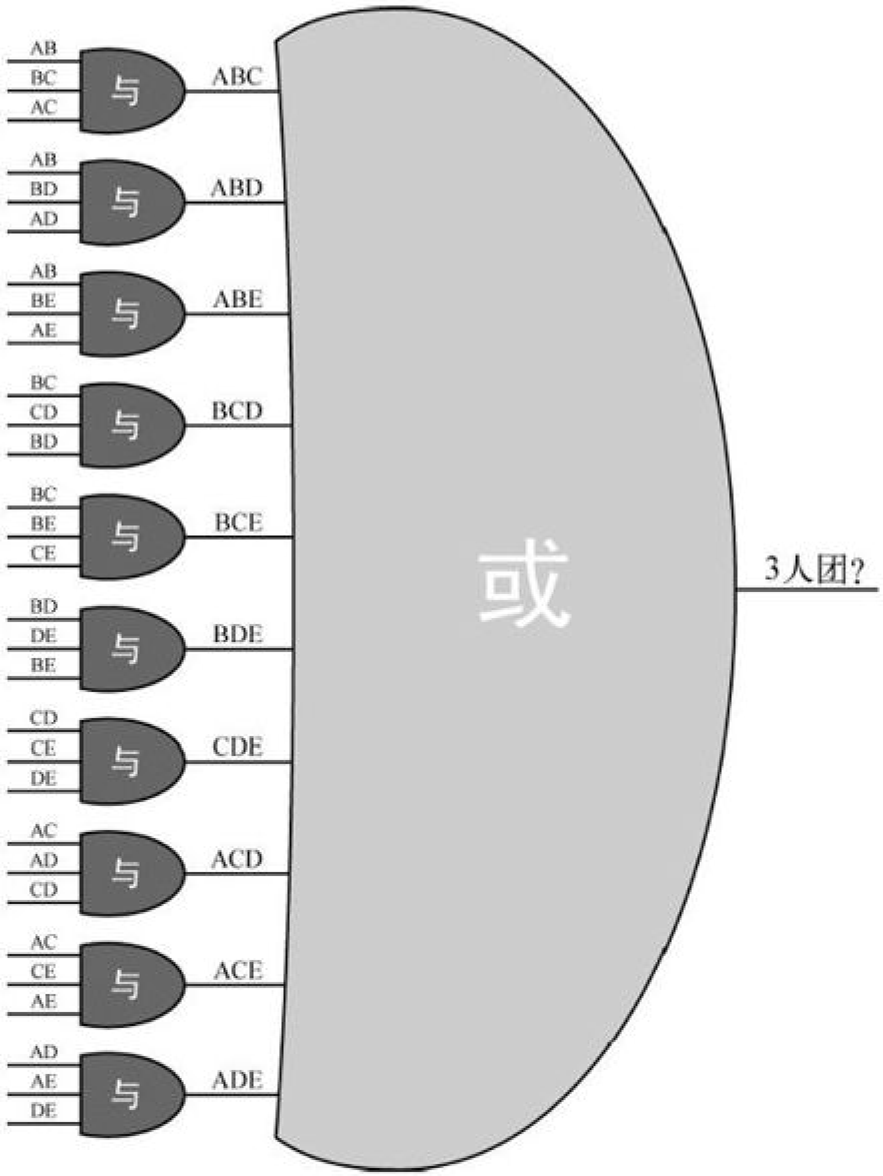
[illegible]7-9 [illegible]

[illegible]Alice[illegible]Bob[illegible]Carol[illegible]David[illegible]Eli[illegible]3[illegible]7-10[illegible]

[illegible]10[illegible]5[illegible]3[illegible]10[illegible]2[illegible]50[illegible]

3 481 788 616 673 927 174 126 704 329 430 033 822 428
741 136 969 800 292 509 234 146 086 195 855 824 730
457 281 170 250 134 309 383 506 694 008 809 661 825
431 661 561 845 957 650 386 210 936 569 600

[illegible]



□7-10 □□□□□□

□□P/NP□□□□□□□□□□□□P□□□NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NP≠P□

□□□□□□□□□□□□□□□□□□□□□□□□□P/NP□□P≠NP□□□

[illegible]

1985[illegible]·[illegible]P/NP[illegible]

[illegible]P/NP[illegible]·[illegible]P/NP[illegible]NP[illegible]NP[illegible]P[illegible]
P≠NP[illegible]

[illegible]P/NP[illegible]P≠NP[illegible]

[illegible]3[illegible]

[illegible]

[illegible]P/NP[illegible]

[illegible]·[illegible]“[illegible]”[illegible]natural proof[illegible]P/NP[illegible]

[illegible]“[illegible]”[illegible]“[illegible]NP[illegible]”[illegible]P/NP[illegible]

7.3 [illegible]P≠NP[illegible]

2010[illegible]8[illegible]6[illegible]·[illegible]22[illegible]“P≠NP”[illegible]P/NP[illegible]“[illegible]”[illegible]P≠NP[illegible]P=NP[illegible]P[illegible]NP[illegible]P/NP[illegible]P/NP[illegible]

> *The Journal of the ACM*[illegible]JACM[illegible]P/NP[illegible]JACM[illegible]JACM[illegible]P/NP[illegible]P/NP[illegible]24[illegible]

[illegible]P/NP[illegible]P/NP[illegible]P/NP[illegible]8[illegible]16[illegible]10[illegible]“[illegible]1[illegible]2[illegible]”[illegible]Step 1: Post Elusive Proof. Step 2: Watch Fireworks[illegible]P/NP[illegible]

[illegible]P/NP[illegible]P/NP[illegible]P/NP[illegible]

[illegible]P/NP[illegible]

[illegible]P/NP[illegible]

[illegible]1550[illegible]·[illegible]P≠NP[illegible]

[illegible]P≠NP[illegible]P≠NP[illegible]Q.E.D.[illegible]Q.E.D.[illegible]quod erat demonstrandum[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]P=NP[illegible]

[illegible]P=NP,“[illegible]”[illegible]NP[illegible]P=NP[illegible]

7.4 [illegible]

[illegible]P≠NP[illegible]

[illegible]P/NP[illegible]·[illegible]P≠NP[illegible]100[illegible]

[illegible]P/NP[illegible]357[illegible]

□8□ □□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□P≠NP□□□□□NP□□□□□□
□□□□□□□□□□□□□□□□1976□□□□□□□·□□□□□·□□□□□□□NP□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

8.1 □□□□□□□

□□□□□□□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

The early bird gets the worm□□□□□□□□□□□Wkh hduob elug jhwv wkh zrup□□□□□□□□□□□□□□□□

加密前	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
加密后	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

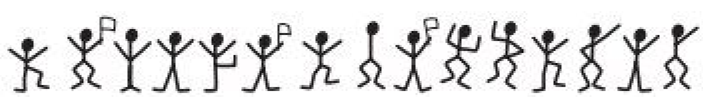
□8-1 □□□

□□□9□□□□□□□□□□□□□□□□□□□□□□□□□□□Wkh hduob elug jhwv wkh zrup□□□□□h□□4□□□□□□□□□□□□□□□□□□e□□□□□□□□□h□e□□□□□Wkh□□□2□□□h□e□□□□□Wkh□the□□□□□□□□□□□□□

□15□□□□□□□□□□□□·□□□·□□□□□□□□□□□□□□□□□□□□□□polyalphabetic cipher□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□19□□□□□□□□□□□□□□□

□□□□□□·□□·□□□□□□□□□□1839□□□□□□□□□□□□□□□□□□□□□□□□□□·□□□□□□“□□□□□”□A Few Words on Secret Writing□□□□□□□□“□□□□□□□□□□□□□□□”□□1843□□□□□□□□*The Gold-Bug*□□□□□□□□□□□□□□□□□□□□

1903□□□·□□·□□□□□□□□□□*The Adventure of the Dancing Man*□□□□□□□□□·□□□□□□□□□□□□□□□□□□□



□8-2 □□□□

□□
（Enigma machine）□□□□□□□·□□□□□1918□□□□

□□□



图8-3 □□□□□□

□□□“□□”（Ultra）□□□·□□□□□□□□□□□“□□”（Colossus）□□□□□□□□□□□□□□□□□·□□□□□□“□‘□□’□□□□□□□□□□”

□□20□□70□□□□□□□□□□□□□□□□□□□NP□□□□□□□□□□□□□□□□□□□□

8.2 [illegible]

“[illegible]”[illegible]1976[illegible]·[illegible]·[illegible]“[illegible]”

[illegible]P/NP[illegible]“[illegible]”

[illegible]

[illegible]20[illegible]Wi-Fi[illegible]

[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“tzljcnnfekktis”[illegible]“tzljcnnfekktis”[illegible]“tzljcnnfekktis”[illegible]“tzljcnnfekktis”[illegible]“[illegible]”[illegible]

□□□□□□□□□□□□□□P=NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□1976□□□□□□□□□□□□□□□P≠NP□□□□□□□□□□□□□□□□□□□□□□□□
□□·□□□□□□□· □□□□□
□□·□□□□□□□□□□□□□1978□□□□□□□□□□□□□□□□RSA□

RSA□□□5 754
853 343□2 860 486 313□□□□□□□□□□□16 461 679 220 973 794
359□□□□□□□□□□□□□□□□□□16 461 679 220 973 794 359□□□5
754 853 343□□2 860 486 313□RSA□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□P≠NP□□
□□□□□

□□□·□□□□□□□·□□□□□□□·□□□□□□□□□□□□□□□2002□□□□□□

□□□□□□□□□□RSA□□□□□□1973□□□□□□·□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□1997□□□□□□□□□

□□□□□□□□□RSA□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□



□8-4　Facebook□□□□□□

□□□https□□□□s□□□□□□□□□□□



□8-5　□□□□Facebook□□□□□□

s□□secure□□□□□Facebook□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□Facebook□□□□□□□□□□□□□□□□□□□□□□□□Wi-Fi□□□□□□□□□□□
□□□□□□□Facebook□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

[illegible]Facebook[illegible]Facebook[illegible]
[illegible]

8.3 P=NP[illegible]

[illegible]2[illegible]“[illegible]”[illegible]5 754 853 343[illegible]2 860 486 313[illegible]5 754 853 343×2 860 486 313=16 461 679 220 973 794 359[illegible]NP[illegible]P=NP[illegible]P=NP[illegible]RSA[illegible]P=NP[illegible]

[illegible]one-time pad[illegible]NP[illegible]12[illegible]FIDDLESTICKS[illegible]JXORMQNAMRHC[illegible]F[illegible]J[illegible]6[illegible]10[illegible]16[illegible]16[illegible]P[illegible]I[illegible]X[illegible]9[illegible]24[illegible]33[illegible]33[illegible]26[illegible]7[illegible]7[illegible]G[illegible]PGSVYVGUVUSV[illegible]Facebook[illegible]Facebook[illegible]

[illegible]12[illegible]P=NP[illegible]

[illegible]JXORMQNAMRHC[illegible]Facebook[illegible]Facebook[illegible]Facebook[illegible]U[illegible]U[illegible]U[illegible]Facebook[illegible]

Facebook[illegible]

8.4

	9			8		4		
		2		4	1			5
3							6	
	1							
7	6			2			1	9
							8	
	2							8
5			2	9		3		
		4		5			2	

8-6

1	9	7	6	8	5	4	3	2
6	8	2	3	4	1	7	9	5
3	4	5	9	7	2	8	6	1
4	1	8	5	6	9	2	7	3
7	6	3	8	2	4	5	1	9
2	5	9	7	1	3	6	8	4
9	2	6	4	3	7	1	5	8
5	7	1	2	9	8	3	4	6
8	3	4	1	5	6	9	2	7

□8-7 □□□□□□□

[illegible]

[illegible]

[illegible]1□9□□□

重排前	重排后
1	2
2	8
3	6
4	5
5	4
6	9
7	1
8	7
9	3

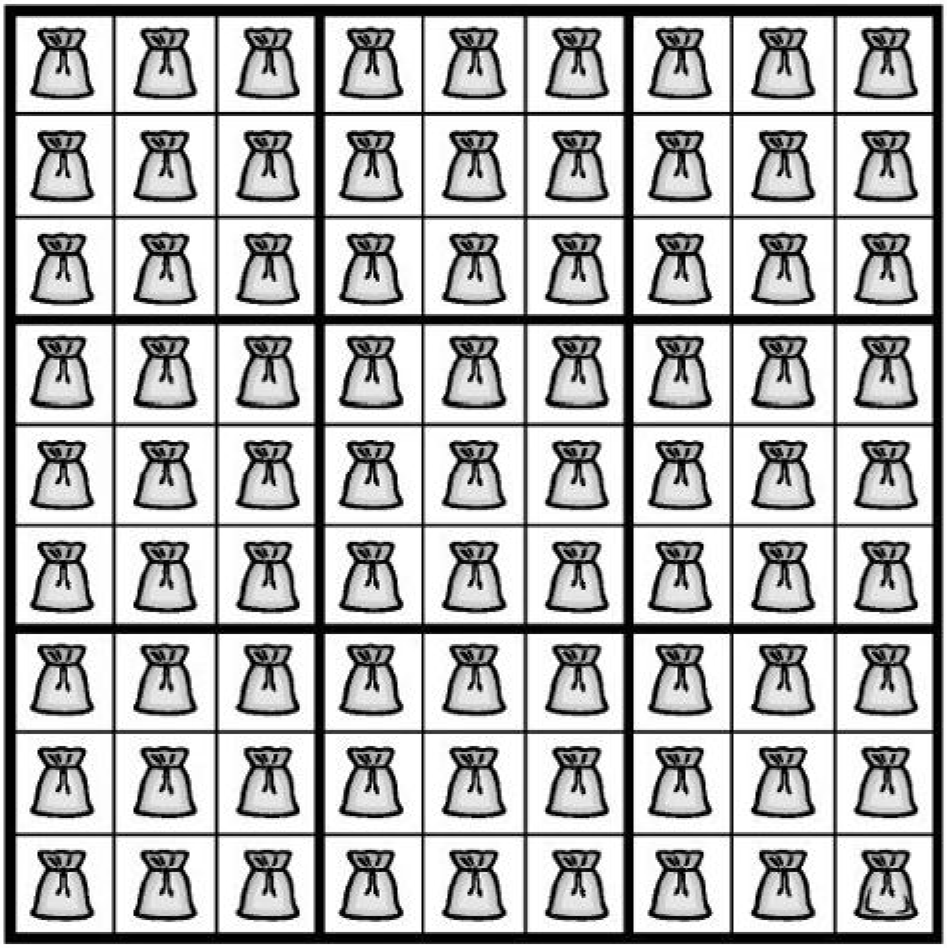
□8-8 □□

□□□□□□□□□□□□□□□□□□□2□□1□3□□9□□□□□□□□□□□□□□□□□□

2	3	1	9	7	4	5	6	8
9	7	8	6	5	2	1	3	4
6	5	4	3	1	8	7	9	2
5	2	7	4	9	3	8	1	6
1	9	6	7	8	5	4	2	3
8	4	3	1	2	6	9	7	5
3	8	9	5	6	1	2	4	7
4	1	2	8	3	7	6	5	9
7	6	5	2	4	9	3	8	1

[illegible]8-9 [illegible]

[illegible]81[illegible]



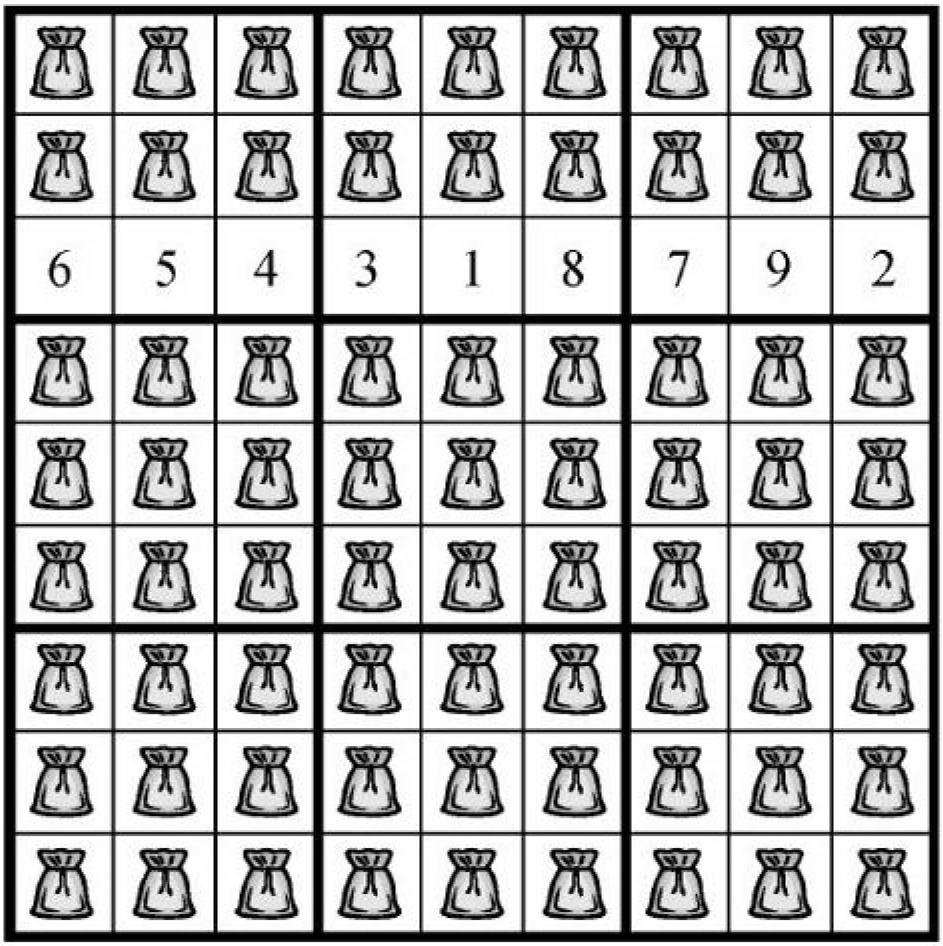
[illegible]8-10 [illegible]

[illegible]2[illegible]3[illegible]

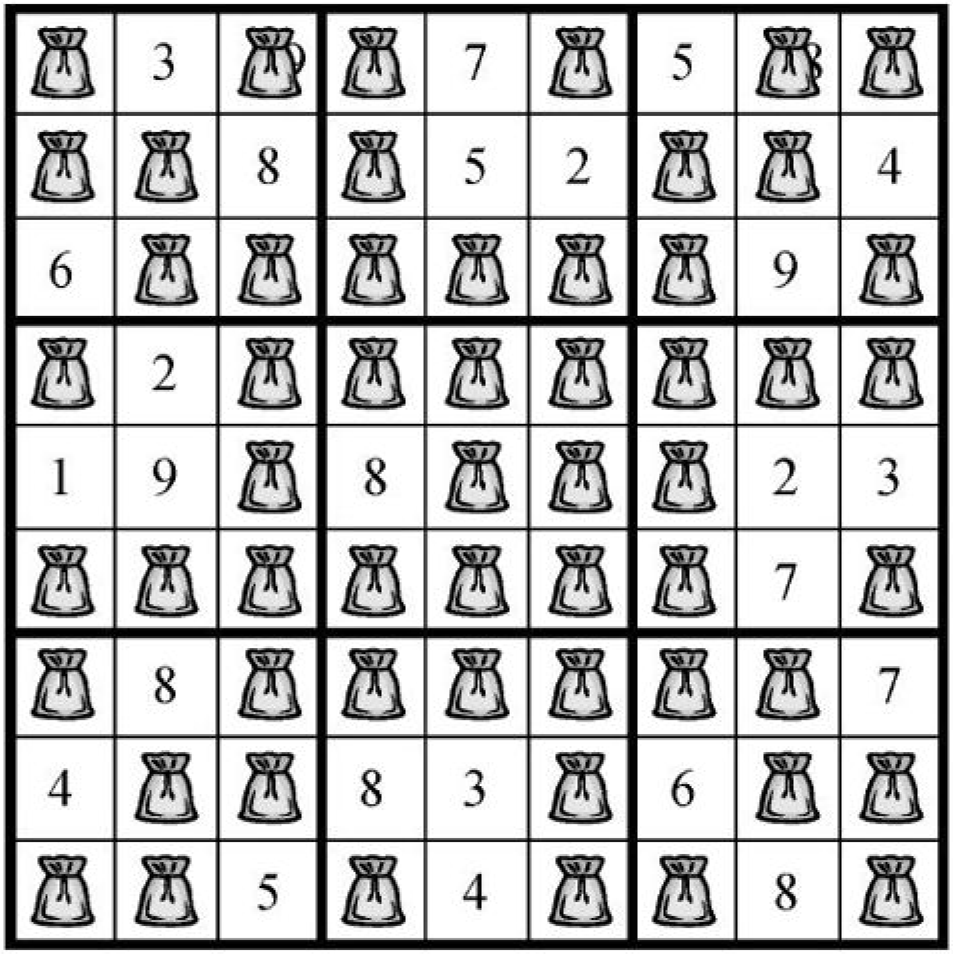
[illegible]28[illegible]

- [illegible]9[illegible]
- [illegible]9[illegible]
- [illegible]9[illegible]3x3[illegible]
- [illegible]

[illegible]3[illegible]



8-11



□8-12   □□□□□□□□□□□□□□□□□□

□□

重排前	重排后
1	2
2	8
3	6
4	5
5	4
6	9
7	1
8	7
9	3

[illegible]8-13 [illegible]

[illegible] 9[illegible]3[illegible]

[illegible] 1[illegible]9[illegible]

[illegible]

[illegible]1/28[illegible]3.57%[illegible]83[illegible]1[illegible]95%[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]2[illegible]3 682 502[illegible]

[illegible]4[illegible]NP[illegible]NP[illegible]NP[illegible]

[illegible]

8.5 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]69 441 251 920 931 124[illegible]

[illegible]69 441 251 920 931 124[illegible]

[illegible]69 441 251 920 931 124[illegible]

[illegible]

[illegible]——[illegible]

[illegible]backgammon[illegible]Monopoly[illegible]

[illegible]

[illegible]

[illegible]20[illegible]70[illegible]80[illegible]

20[illegible]80[illegible]90[illegible]

8.6 [illegible]

[illegible]

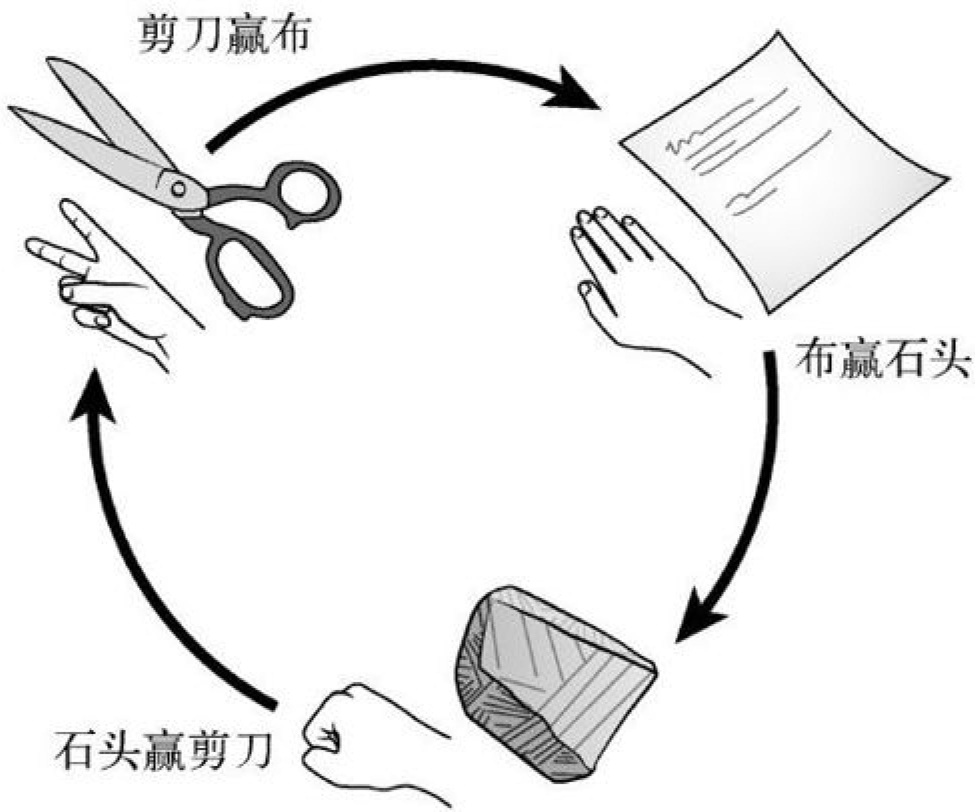
[illegible]homomorphic[illegible]RSA[illegible]28[illegible]45[illegible]1260[illegible]RSA[illegible]28[illegible]45[illegible]73[illegible]

[illegible]

[illegible]

[illegible]2009[illegible]·[illegible]

8.7



8-14

[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]P=NP[illegible]

8.8 [illegible]

[illegible]NP[illegible]

[illegible]NP[illegible]NP[illegible]P≠NP[illegible]

[illegible]NP[illegible]P≠NP[illegible]

20[illegible]70[illegible]

[illegible]

[illegible]

[illegible]

[illegible]9[illegible] [illegible]

1982[illegible]·[illegible]
[illegible]quantum teleportation[illegible]

9.1 [illegible]

[illegible] 9 [illegible] · [illegible]

[illegible]

[illegible]

[illegible] 200 [illegible]

[illegible] bit [illegible] binary digit [illegible] quantum bit [illegible]

[illegible]

[illegible]

[illegible]

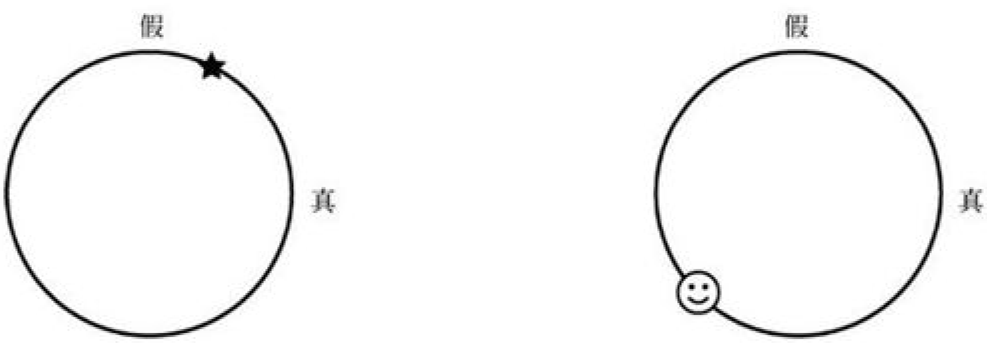
[illegible]



[illegible]9-1 [illegible]

[illegible]30%[illegible]

[illegible]



[illegible]9-2 [illegible]

[illegible](0.55[illegible], 0.84[illegible])[illegible]([illegible]0.71[illegible], [illegible]0.71[illegible])[illegible]

[illegible]30[illegible]1[illegible]

[illegible]NP[illegible]2[illegible]50[illegible]500[illegible]50[illegible]

[illegible]“[illegible]”[illegible]3×10^{150}[illegible]3[illegible]150[illegible]0[illegible]NP[illegible]

[illegible] 3×10^{150} [illegible] 1996 [illegible]·[illegible]“[illegible]”[illegible] 2×10^{75} [illegible] 1 [illegible] 5 [illegible]

[illegible] NP [illegible] P=NP [illegible]

[illegible] NP [illegible]

1994 [illegible]·[illegible] 16 461 679 220 973 794 359 [illegible] 5 754 853 343 [illegible] 2 860 486 313 [illegible] 5 754 853 343×2 860 486 313=16 461 679 220 973 794 359 [illegible] NP [illegible] NP [illegible]

[illegible]“[illegible]”[illegible]

[illegible] 5 [illegible]

[illegible] D-Wave [illegible]

[illegible] NP [illegible]

9.2 [illegible]

[illegible]8[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

1979[illegible]·[illegible]IEEE[illegible]
[illegible]Foundations of Computer Science conference[illegible]
[illegible]IBM[illegible]·[illegible]

[illegible]

[illegible]–[illegible]148[illegible]145[illegible]

[illegible]

[illegible]
[illegible]
[illegible]

9.3 □□□□□□□

1996□2□□□□□□□□□□□□□□IBM□□□□□□□□□□□□□□

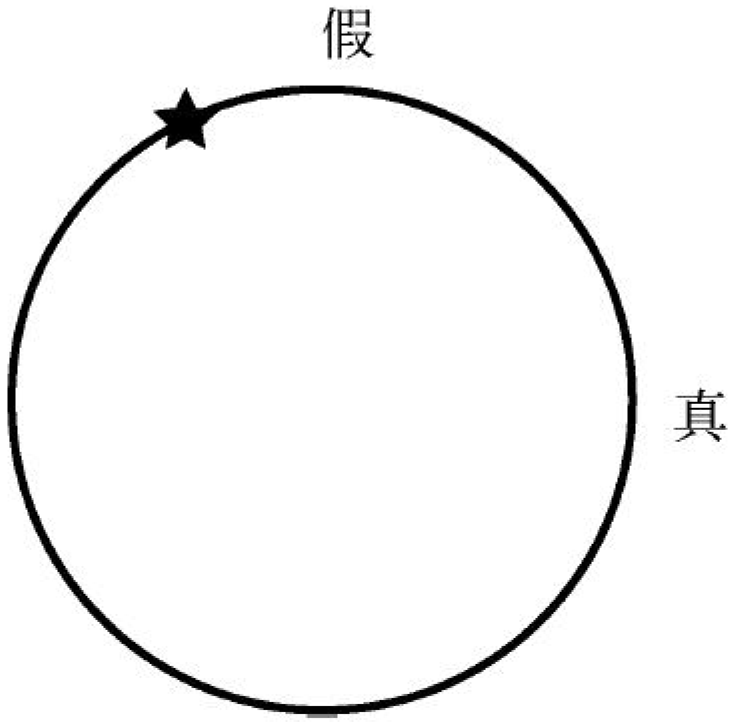
> □□“□□□□□□□□□□□□□□□teleport□□□□□□□□□□□”□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□IBM□□



□9-3 IBM□□□□□IBM□□□□

□□1993□□IBM□□□□□□□□□·□□□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□



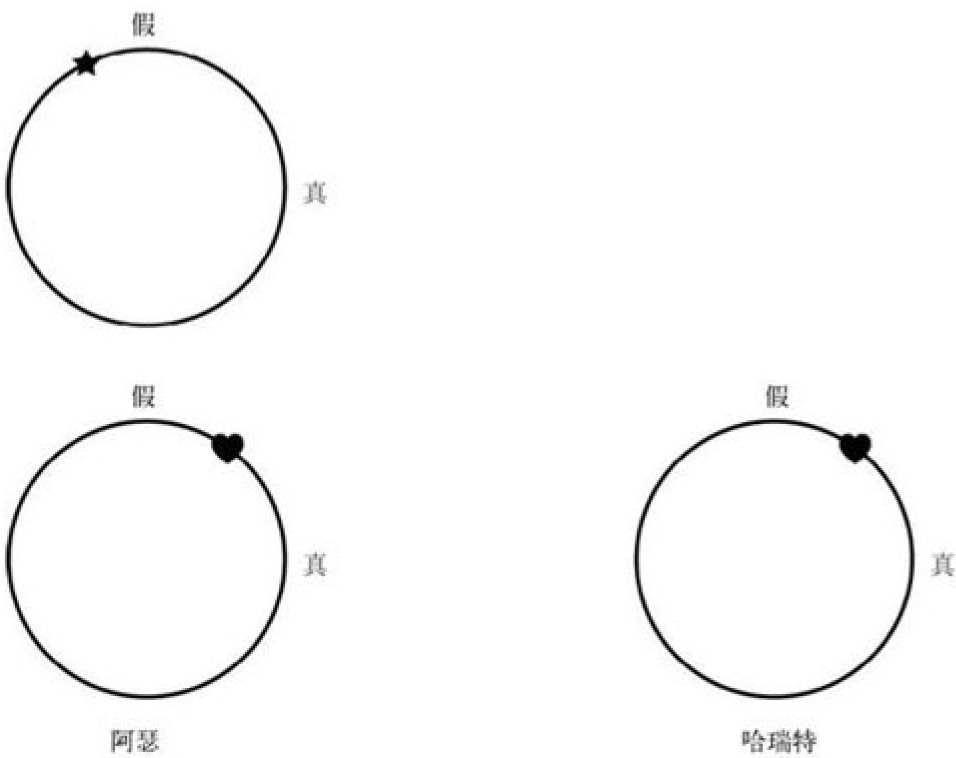
[illegible]9-4 [illegible]

[illegible]

[illegible](-0.55[illegible], 0.84[illegible])[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]



[illegible]9-5 [illegible]

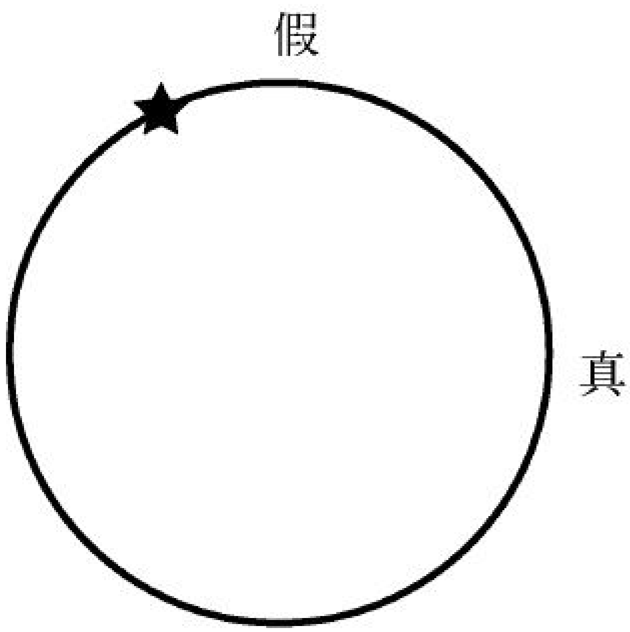
[illegible]0[illegible]1[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]



[illegible]9-6

9.4 [illegible]

[illegible]NP[illegible]

[illegible]20[illegible]90[illegible]

[illegible]

□10□　□□

□□□□P/NP□□□□□□□□□□□□□□□□□□P≠NP□□□□□□□□□□□□□□□□□□□□
□2□□□□□□□□□□□□□□□□□□□□□□□□□P/NP□□□□□□□□□□□□□□□□□□□
□□

P/NP□□
□□

- □□□□□□□□□18□24□□
- □□□
- □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□Facebook□□□

□□□□□□□□P=NP□□P≠NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□

10.1 [illegible]

1965[illegible]·[illegible]10[illegible]“[illegible]”[illegible]1975[illegible]

[illegible]2005[illegible]

[illegible]

[illegible]IBM[illegible]Watson[illegible]2011[illegible]2[illegible]*Jeopardy*[illegible]90[illegible]IBM POWER 750[illegible]4[illegible]POWER7[illegible]POWER7[illegible]8[illegible]8[illegible]32[illegible]2880[illegible]2880[illegible]*Jeopardy*[illegible]“[illegible]”[illegible]2880[illegible]

[illegible]

P/NP[illegible]·[illegible]NP[illegible]NP[illegible]100[illegible]10[illegible]1×10^{18}[illegible]10^{100}[illegible]P/NP[illegible]

[illegible]P[illegible]

□P□NP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□NC□□□Nick's Class□□□□□□□□□□□□□□□□·□□□□□□P=NC□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□P=NC□□□□□□□NP=NC□NP=NC□□□□□□NP□□□P=NP□□□□□□□□NP=NC□□□□□□□□□□P=NP□□□□□□□□□□□□□□□

10.2 □□□□□

□1□□□□□□□□□□□□35□□□YouTube□□□1600□Twitter□□□□□11 000□Facebook□□□50 000□Google□□□□□□□300□□□□□□□□□□□90%□□□□□□□□

□□□□□□□□□□□□□□□□□□□20□□□□□□□1□□□□□□□□1□□□□□□□□□□□□□□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□□□350□□□□□□□

□□□□□□□□□□□□□□□□□□□□□LHC□□□□□□□□□□□□□□□□□□□□□5□□□□□□□□□□□□□□□□□□□□□□□3100□□□

CERN□□LHC□□□□□□□□□□□□□□□□□□34□□□□□□□□□□□□□□□□□□□□□□□□LHC□□□□

□□DNA□□□□□□5500□□□□□□□□□□70□□□□□□□□□□□4×10^17□□□□□□□□□□□□□□□□□

□□“□□□□□□□□□□□□□□□”□

□□

□□□P=NP□□

□□

□□□Google□□□

[illegible]

10.3 [illegible]

[illegible]20[illegible]20[illegible]

[illegible]Wi-Fi[illegible]“[illegible]”[illegible]

[illegible]

[illegible]P/NP[illegible]

Sun[illegible]20[illegible]90[illegible]“[illegible]”[illegible]

10.4 [illegible]

[illegible]

[illegible]20[illegible]50[illegible]·[illegible]*On the Waterfront*[illegible]*All in the Family*[illegible]

[illegible]Twitter[illegible]

[illegible]

[illegible]

[illegible]2010[illegible]Deepwater Horizon[illegible]2011[illegible]

10.5 [illegible]P/NP[illegible]

[illegible]P≠NP[illegible]NP[illegible]

[illegible]20[illegible]200[illegible]2000[illegible]P≠NP[illegible]P/NP[illegible]

P/NP[illegible]P≠NP[illegible]NP[illegible]NP[illegible]

P/NP[illegible]NP[illegible]

P/NP[illegible]P/NP[illegible]P/NP[illegible]

[illegible]P/NP[illegible]P/NP[illegible]

[illegible]

[illegible]P/NP[illegible]“Computational Complexity”[illegible]

[illegible]

[illegible]http://press.princeton.edu/titles/9937.html[illegible]P/NP[illegible]

[illegible]

Lance Fortnow, “The Status of the P versus NP Problem,” *Communications of the ACM* 52, no. 9 (September 2009): 78–86.

Stephen Hawking, *A Brief History of Time: From the Big Bang to Black Holes* (New York: Bantam Dell, 1988).

[illegible]1[illegible]

[illegible]·[illegible]·[illegible]*Charlie and the Chocolate Factory* (New York: Knopf, 1964)[illegible]

[illegible]2010 CRA Snowbird Conference[illegible]2010[illegible]7[illegible]18[illegible]

[illegible]Mark Daskin[illegible]http://sitemaker.umich.edu/msdaskin/software[illegible]

[illegible]2[illegible]

□□2.4□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□P=NP□□□□

□3□

□□□□□□□□□□□□□□Stanley Milgram, “The Small World Problem,” *Psychology Today* 2, no. 1 (1967): 60–67□

□□□□□□□□□Internet Movie Database□

□□□□□□□□□□□□□□□□□□□□□Robin Wilson, *Four Colors Suffice: How the Map Problem Was Solved* (Princeton, NJ: Princeton University Press, 2004)□

□4□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

> The theorems suggest that {tautologies} is a good candidate for an interesting set not in L*, and I feel it is worth spending considerable effort trying to prove this conjecture. Such a proof would be a major breakthrough in complexity theory.

Steve Cook, “The Complexity of Theorem-Proving Procedures,” in *Proceedings of the Third Annual ACM Symposium on Theory of Computing* (New York: ACM), 151–158.

□□□□□□□□□□□□Richard Karp, “Reducibility among Combinatorial Problems,” *Complexity of Computer Computations* 40, no. 4 (1972): 85–103□

Bob Sehlinger (author) and Len Testa (contributor), *The Unofficial Guide Walt Disney World 2010* (New York: Wiley, 2010).

4.3□□□□□□Donald Knuth, “A Terminological Proposal,” *ACM SIGACT News* 6, no. 1 (January 1974): 12–18□

Kevin Sack, “60 Lives, 30 Kidneys, All Linked,” *New York Times*, February 19, 2012, A1.

□5□

□□□□□□□□□□□□□□□

Lance Fortnow and Steve Homer, “A Short History of Computational Complexity,” *Bulletin of the European Association for Theoretical Computer Science* 80 (June 2003)□“Computational Complexity” □□□□□□□□□□□□□□□□□□□□□□·□□□□□□□·□□□□

Dennis Shasha and Cathy Lazere, “A Good Solution Is Hard to Find,” in *Out of Their Minds: The Lives and Discoveries of 15 Great Computer Scientists* (New York: Springer, 1995).

Juris Hartmanis, “Observations about the Development of Theoretical Computer Science,” *Annals of the History of Computing* 3, no. 1 (January 1981): 42–51.

B. A. Trakhtenbrot, “A Survey of Russian Approaches to Perebor (Brute-Force Search) Algorithms,” *Annals of the History of Computing* 6, no. 4 (October 1984): 384–400.

Michael Sipser, “The History and Status of the P versus NP Question,” in *Proceedings of the 24th Annual ACM Symposium on Theory of Computing* (New York: ACM, 1992), 603–618. □□□□□□□□□□□□□□·□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□2003□4□27□□5□2□□□□□□□□Dagstuhl□□□“Computational Complexity”□□□□2003□5□1□□

Alan Cobham, “The Intrinsic Computational Difficulty of Functions,” in *Proceedings of the 1964 International Congress for Logic, Methodology, and Philosophy of Science*, 24–30.

Stephen Cook, “The Complexity of Theorem-Proving Procedures,” in *Proceedings of the Third Annual ACM Symposium on Theory of Computing* (New York: ACM, 1971), 151–158.

Jack Edmonds, “Paths, Trees and Flowers,” *Canadian Journal of Mathematics* 17 (1965): 449–467.

Juris Hartmanis and Richard Stearns, “On the Computational Complexity of Algo- rithms,” *Transactions of the American Mathematical Society* 117 (1965): 385–406.

Richard Karp, “Reducibility among Combinatorial Problems,” *Complexity of Computer Computations* 40, no. 4 (1972): 85–103.

Leonid Levin, “Universal Sequential Search Problems” [in Russian], *Problemy Pred. Informatsii* 9, no. 3 (1971): 265–266. Translation in B. A. Trakhtenbrot, “A Survey of Russian Approaches to Prebor (Brute-Force Search) Algorithms,” *Annals of the History of Computing* 6, no. 4 (October 1984): 384–400.

Warren McCulloch and Walter Pitts, “A Logical Calculus of the Ideas Immanent in Nervous Activity,” *Bulletin of Mathematical Biology* 5, no. 4 (1943): 115–133.

Panel discussion, *Complexity of Computer Computations* 40, no. 4 (1972): 169–185.

Alan Turing, “On Computable Numbers, with an Application to the Entscheidungsproblem,” *Proceedings of the London Mathematical Society* 42 (1936): 230–265.

S. Yablonsky, “On the Impossibility of Eliminating PEREBOR in Solving Some Problems of Circuit Theory,” *Doklady Akademii Nauk SSSR* 124 (1959): 44–47.

Y. Zhuravlev, “On the Impossibility of Constructing Minimal Disjunctive Normal Forms for Boolean Functions by Algorithms of a Certain Class,” *Doklady Akademii Nauk SSSR* 132 (1960): 504–506.

[illegible]6[illegible]

[illegible][1][illegible]“CRPC Researchers Solve Traveling Salesman Problem for Record-Breaking 13,509 Cities”[illegible]2003[illegible]

1 [illegible]Mark Daskin [illegible]http://sitemaker.umich.edu/msdaskin/software[illegible]

[illegible]http://cstheory.stackexchange.com/questions/4027/coloring-planar-graphs[illegible]

[illegible]David P. Dailey, “Uniqueness of Colorability and Colorability of Planar 4-Regular Graphs Are NP-Complete”, *Discrete Mathematics* 30 (1980): 289–293[illegible]

[illegible]7[illegible]

[illegible]·[illegible]1985[illegible]

□□P/NP□□□□□JACM□□□□□
□http://jacm.acm.org/instructions/pnp□□

□□□·□□□□□□P/NP□□□□□□□2010□8□6□□□□□□□□□□□□□□□□□□□□□21
□□□□□

□□□□□□□□□David Kahn, *The Codebreakers: The Story of Secret Writing* (New York: Macmillan, 1967)□

□8□

□□□□□□□□□□□□□□□□□□□□David Kahn□□□□*The Codebreakers: The Story of Secret Writing* (New York: Macmillan, 1967)□

□□□□□□□□□□□□□□□□□2006□8□3□□□□□□□□□□□□□□□□
□“Computational Complexity”□□
http://blog.computationalcomplexity.org/2006/08/zero-knowledge-sudoku.html□

□□□□

Whitfield Diffie and Martin Hellman, “New Directions in Cryptography,” *IEEE Transactions on Information Theory* 22, no. 6 (November 1976): 644–654.

Craig Gentry, “Fully Homomorphic Encryption Using Ideal Lattices,” in *Proceedings of the 41st Annual ACM Symposium on Theory of Computing* (New York: ACM, 1979), 169–178.

Ronald Rivest, Adi Shamir, and Leonard Adleman, “A Method for Obtaining Digital Signatures and Public-Key Cryptosystems,” *Communications of the ACM* 21, no. 2 (February 1978): 120–126.

□9□

□□□□□·□□□□□□□□□□□□□□□□□□□David Deutsch□□□□“Quantum Computation,” *Physics World*, January 6, 1992□

□□□□

Charles Bennett and Gilles Brassard, “Quantum Cryptography: Public Key Distribution and Coin Tossing,” *Proceedings of the IEEE International Conference on Computers, Systems, and Signal Processing* (Amsterdam: Elsevier, 1984), 175–179.

Charles Bennett, Gilles Brassard, Claude Crépeau, Richard Jozsa, Asher Peres, and William K. Wootters, “Teleporting an Unknown Quantum State via Dual Classical and Einstein-Podolsky-Rosen Channels,” *Physical Review Letters* 70 (1993): 1895–1899.

Lov Grover, “A Fast Quantum Mechanical Algorithm for Database Search,” in *Proceedings of the Twenty-Eighth Annual ACM Symposium on Theory of Computing* (New York: ACM, 1996), 212–219.

Stephen Pincock, *Codebreaker: The History of Codes and Ciphers* (New York: Walker and Co., 2006), 151, for the Bennett and Brassard beach story.

Peter Shor, “Polynomial-Time Algorithms for Prime Factorization and Discrete Loga- rithms on a Quantum Computer,” *SIAM Journal on Computing* 26 (1997): 1484–1509.

□10□

□□□□□□Gordon Moore□“Cramming More Components onto Integrated Circuits,” *Electronics* 38, no. 8 (April 19, 1965)□

□□□□□□□□□□IBM□“What Runs IBM Watson and Why”□□□□ □□□ David Davidian□

□□□□□□□□Marc Levinson, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger* (Princeton, NJ: Princeton University Press, 2008)□

□□□□□□□□□□□

http://www.youtube.com/t/press_statistics

http://techcrunch.com/2011/03/14/new-twitter-stats-140m-tweets-sent-per-day-460k-accounts-created-per-day/

http://www.facebook.com/press/info.php?statistics

http://email.about.com/od/emailtrivia/f/emails_per_day.htm

http://public.web.cern.ch/public/en/lhc/Computing-en.html

http://space.about.com/od/telescopesandoptics/p/hubbleinfo.htm

http://webbtelescope.org/webb_telescope/technology_at_the_extremes/quick_facts.php

http://royal.pingdom.com/2011/01/12/internet-2010-in-numbers/

□□□

A

Adi Shamir □□·□□□
Alan Cobham □□·□□□
Alan Turing □□·□□
Albert Einstein □□□□·□□□□
Albert Meyer □□□·□□
Alexander Razborov □□□□·□□□□□
Alexey Liapunov □□□□·□□□□□
Alfred Kempe □□□□□·□□
Alonzo Church □□□·□□
Andrew Wiles □□□·□□□
Andrey Kolmogorov □□□·□□□□□□
Arthur Conan Doyle □□·□□·□□
Arthur Scherbius □□·□□□□□

B

Boris Trakhtenbrot □□□·□□□□□
Brian Hammer □□□·□□

C

Charlie Bennett □□·□□□
Charlie Chaplin □□·□□□
Claude Berge □□□·□□
Claude Shannon □□□·□□
Clifford Cocks □□□□·□□□
Craig Gentry □□□·□□□
Cy Young □·□

D

David Hilbert □□·□□□□
David Williamson □□·□□□

E

Edgar Allan Poe □□□·□□·□
Edward Kasner □□□·□□□
Eli Wallach □□·□□□

F

Francis Guthrie □□□□·□□□

G

George Brown □□·□□
Georg Dantzig □□□□·□□□
Gerolamo Cardano □□□□·□□□□
Gilles Brassard □□□·□□□□
Gordon Moore □□·□□
Gregory Chaitin □□□□·□□
Grigori Perelman □□□□·□□□□

H

Humphrey Bogart □□□·□□

I

Isaac Newton □□□·□□

J

Jack Edmonds □□·□□□□
James Webb □□□·□□
Joe DiMaggio □·□□□
Joe Mitchell □·□□□
Johannes Kepler □□□□·□□□
John Nash □□·□□
John von Neumann □□·□·□□□
Julia Roberts □□□·□□□
Julius Caesar □□□□·□□
Juris Hartmanis□□□·□□□□□

K

Kenneth Appel □□□·□□□
Ketan Mulmuley □□·□□□□
Kevin Bacon □□·□□
Knuth □□□
Kurt Gödel □□□·□□□

L

Lance Fortnow □□·□□□
Leonard Adleman □□□·□□□
Leon Batista Alberti □□·□□□□·□□□□
Leonhard Euler □□□□·□□
Leonid Khachiyan □□□□·□□□
Leonid Levin □□□□·□□
Lov Grover □□·□□□

M

Malcolm McLean □□□□·□□□□
Manindra Agrawal □□□·□□□□□
Manuel Blum □□□·□□□
Martin Hellman □□·□□□
Michael Sipser □□□·□□□
Michel Goemans □□□·□□□
Milena Pavel □□□·□□□
Minsk Borov □□□·□□□
Moshe Vardi □□·□□
Muhammad ibn Mūsā al-Khwārizmī □□□□·□□·□□·□□□□

N

Narendra Karmarkar □□□□·□□□
Neeraj Kayal □□□·□□□
Nicholas Pippenger □□□□·□□□
Nitin Saxena □□·□□□□
Noam Chomsky □□·□□□□

P

Paul Erdős □□·□□□
Pete Johnson □□·□□□
Peter Shor □□·□□
Peter Tait □□·□□
Pierre de Fermat □□□·□·□□
Pyotr Novikov □□·□□□□

R

Ray Solomonoff □·□□□□□
René Descartes □□·□□□
Richard Feynman □□□·□□
Richard Karp □□□·□□
Richard Stearns □□□·□□□□
Roald Dahl □□□·□□
Roger Merkle □□·□□□
Ronald Rivest □□□·□□□□

S

Sanjeev Arora □□□·□□□
Sergey Yablonsky □□□·□□□□□
Sherlock Holmes □□□·□□□□
Sophia Loren □□□·□□
Stephen Hawking □□□·□□
Stephen Kleene □□□·□□□
Steve Cook □□□·□□
Steve Frank □□□·□□□
Steven Rudich □□□·□□□
Subhash Khot □□□□·□□

T

Tim Burton □□·□□
Tom Hull □□·□□
Tom Jones □□·□□

V

Veruca Salt □□□·□□□
Vinary Deolalikar □□□·□□□□□

W

Walter Pitts □□□·□□
Warren McCulloch □□·□□□□
Whitfield Diffie □□□□□·□□
William of Ockham □□□□□□
William Rowan Hamilton □□·□□·□□□
Willie Wonka □□·□□
Winston Churchill □□□·□□□
Wolfgang Haken □□□□·□□

Y

Y. M. Barzdin Y. M. □□□
Yoky Matsuoka □□□□

Z

Zhuravlev □□□□□

05. [illegible] - [illegible] [illegible]

2000[illegible]10[illegible]2[illegible]

[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible]

[illegible] [illegible] [illegible] [illegible]
[illegible]NASA[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible]*[illegible]*[illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible]

[illegible] [illegible]
[illegible] [illegible]

[illegible]*[illegible]*[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]*[illegible]*[illegible]

[illegible] [illegible]“[illegible]
[illegible]” [illegible] [illegible] [illegible]
[illegible]

[illegible] [illegible]2.0[illegible]

[illegible] [illegible]1.0[illegible]2.0[illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] Nanner Splits
Unlimited[illegible]

Nanner Splits[illegible]2.0[illegible]*[illegible]*[illegible]1.0[illegible] [illegible]*[illegible]*[illegible] [illegible]
[illegible] [illegible]“[illegible]”[illegible] [illegible] [illegible]*[illegible]*[illegible]2.0[illegible] [illegible]
[illegible]1.0[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]4[illegible]

[illegible] 20[illegible]
[illegible]

- [illegible]

[illegible]“[illegible]” [illegible]

- [illegible]

[illegible]20[illegible]

[illegible]

- [illegible] V1[illegible]V2[illegible] V1[illegible] V2[illegible]V1[illegible] V1::Save[illegible] V2::Save[illegible] V1[illegible]V2[illegible]

20[illegible]

[illegible]3[illegible]2[illegible]

[illegible]3[illegible]1[illegible]4[illegible]

[illegible]“[illegible]” [illegible]“[illegible]”

[illegible] warts [illegible]

[illegible] , [illegible] “[illegible]” [illegible]

[illegible] [[illegible]] [illegible]

- [illegible]LRF-1914[illegible]

[illegible]“[illegible]”[illegible]

- [illegible]LRF-1914[illegible]LRF-1914[illegible] [illegible]LRF-1914[illegible] [illegible]“[illegible]”[illegible]“Y”[illegible] [illegible]LRF-1914[illegible] [illegible]“[illegible]”[illegible]“N”[illegible]

[illegible] *[illegible]LRF-1914[illegible]* [illegible] a[illegible] b[illegible] c[illegible]

[illegible] [illegible] [illegible]14 [illegible] [illegible]“[illegible]”* [illegible]3D[illegible]——[illegible][illegible]“[illegible]”[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] *[illegible]*[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible][illegible][illegible]

[illegible] [illegible]*[illegible]*[illegible] Windows 2000 [illegible]·[illegible][illegible]: “[illegible]10[illegible] [illegible]”

[illegible] [illegible] [illegible] [illegible] [illegible]*[illegible]*[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] *[illegible]*[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]*[illegible]*[illegible] [illegible] [illegible]

“[illegible] [illegible] [illegible]” [illegible]*[illegible]*[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]*[illegible]*[illegible] [illegible] [illegible]“[illegible]”[illegible]300[illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]3[illegible]5[illegible] [illegible] [illegible] [illegible] [illegible] [illegible][illegible][illegible] [illegible]

[illegible] [illegible]4[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

Table of Contents